Madison River/Ennis Reservoir Fisheries

and

Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program

2001 Annual Report
to
PPL Montana
Environmental Division
Butte

and

Turner Enterprises, Inc.
Bozeman

by

Pat Clancey
Montana Fish, Wildlife, & Parks
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Montana Fish, Wildlife & Parks

EXECUTIVE SUMMARY

No young-of-the-year Arctic grayling, whitefish, rainbow, or brown trout were captured during seining in Ennis Reservoir in 2001, however two adult grayling were captured during gillnetting. Populations of both yearling and two year old & older rainbow trout in the Pine Butte and Varney monitoring sections decreased from 2000 to 2001, but two year old & older rainbows increased substantially in the Norris section. Two year old & older brown trout numbers remained high in the Pine Butte and Varney sections, despite a slight decrease in each, but yearling numbers in both sections decreased noticeably. Two year old & older brown trout numbers increased in Norris. Estimates were also completed in the Snoball section. Low water conditions in the Madison River during 2001 prevented field studies designed to test the affect of river discharge on whirling disease infection rate and severity. Water temperature was monitored at 14 sites throughout the Madison River, and air temperature at 7 sites. An Environmental Assessment was prepared to assess a proposed eradication effort of New Zealand Mud Snails in Darlinton Ditch, a spring creek along the lower Madison River. Litigation filed in federal district court against the Cherry Creek Native Fish Introduction Project was withdrawn by the litigants. Motions for Summary Judgment were submitted to the Montana District Court in 2001, though the court took no action in 2001. Gametes were successfully collected from two streams for development of a local westslope cutthroat trout broodstock, but genetic testing revealed that one of the populations was less than 90 percent pure. A record keeping error resulted in fry from both streams being stocked into a rearing pond. An Environmental Assessment was prepared to evaluate alternatives for removing the fish from the pond. A year-long creel census on Hebgen Reservoir was completed in 2001. Catch rates were 0.29 fish/hour for rainbow trout and 0.09 fish/hour for brown trout. A westslope cutthroat trout habitat rehabilitation project was completed on the upper South Fork of the Madison River.

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INTRODUCTION

Montana Fish, Wildlife, & Parks (MFWP) has conducted fisheries studies in the Madison River Drainage since 1990 to assess the status of the Arctic grayling (*Thymallus arcticus*) population of Ennis Reservoir, and to address effects of hydropower operations at Hebgen and Ennis dams on fisheries (Byorth and Shepard 1990, MFWP 1995, MFWP 1996, MFWP 1997a, MFWP 1998, MFWP 1999, MFWP 2000, MFWP 2001a). This work has been funded through an agreement, initially with Montana Power Company (MPC), now with PPL Montana, owner and operator of the dams. The original agreement between MFWP and MPC was designed to anticipate relicensing requirements for MPC's hydropower system on the Madison and Missouri Rivers, which includes Hebgen and Ennis dams, as well as seven dams on the Missouri River (Figure 1). PPL Montana has maintained the direction set by MPC, and convened several committees to address fisheries, wildlife, water quality, and recreation issues related to the operation of the hydropower facilities on the Madison and Missouri rivers. These committees are composed of representatives of PPL Montana and several agencies. The Madison Fisheries Technical Advisory Committee (TAC) is composed of personnel of PPL Montana, MFWP, the U.S. Fish & Wildlife Service (USFWS), the U.S. Forest Service (USFS), and the U.S. Bureau of Reclamation (BLM). Each entity has equal authority in decision making within the TAC. Collectively, the nine dams on the Madison and Missouri rivers are called the 2188 Project, which refers to the Federal Energy Regulatory Commission (FERC) license number that authorizes their operation. The Federal Energy Regulatory Commission issued PPL Montana a license to operate the 2188 Project for 40 years (Federal Energy Regulatory Commission 2000). The license details the terms and conditions PPL Montana must meet during the license term, including fish, wildlife, and recreation protection, mitigation, and enhancement measures.

Late in 1996, MFWP initiated a ten-year program entitled "The Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program". The goal of this effort is to conserve and restore the native westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in the Madison River drainage. Fieldwork for this effort began in 1997 in tributaries of the Madison River. The agreement between MFWP and PPL Montana includes provisions to address issues regarding species of special concern.

In recognition of the severity of the situation faced by the westslope cutthroat trout, and in keeping with the philosophy of promoting native species on their lands, Turner Enterprises, Incorporated (TEI) offered access to the Cherry Creek drainage on the Flying D Ranch to assess its suitability for introducing westslope cutthroat. MFWP determined in 1997 that introducing westslope cutthroat to Cherry Creek is feasible, but would require the removal of all non-native trout presently in that portion of the drainage. MFWP, TEI, and the Gallatin National Forest (GNF) subsequently entered into an agreement to pursue this effort. The agreement outlines the roles and responsibilities of each party, including the GNF, which manages the public land at the upper end of the Cherry Creek drainage.

The Sun Ranch has entered into an agreement to assist MFWP with westslope cutthroat trout conservation and recovery. The ranch built a small hatchery facility and a rearing pond to facilitate development of a westslope cutthroat trout broodstock for the Madison and Missouri river drainages, and provided personnel to assist with fieldwork and conduct hatchery operations.

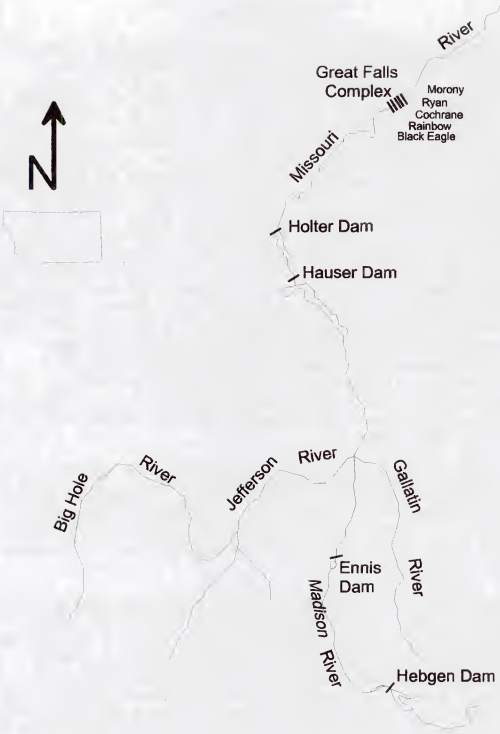

Figure 1. Locations of PPL Montana dams on the Madison and Missouri rivers.

Madison Grayling

A beach seine (Figure 2) is used to monitor index sites in Ennis Reservoir (Figure 3) for young-of-the-year grayling and other fish species. A 125'x 5'x ¼" mesh seine with a 5'x 5'x 5' bag is fed off a moving boat in water up to five feet deep, with a worker in the water at each end of the seine. The seine is pulled through shallow water near the shoreline for some distance, then onto the shoreline where captured fish are enumerated by species. If beds of macrophytes (aquatic plants) where juvenile fish are likely to rear are present and accessible, the seine is pulled through them.

Figure 2. Beach seining in Ennis Reservoir.

Figure 3. Locations of Ennis Reservoir seining and gillnetting sites. Letters represent gillnetting sites, numbers indicate seining sites.

Gillnetting

Gillnets were used to sample adult fish in Ennis Reservoir in late August 2001. Experimental nets, composed of five 25-foot panels of progressively larger mesh (¾", 1", 1 ¼", 1 ¾" 2") were set at four locations and left to fish overnight (Figure 3). For shoreline sets, the smallest mesh was set in the shallowest water, the largest mesh in the deepest water. Floating nets were used at the shallow south end of the reservoir, and one floating and one sinking net were used at the north end. Because the south end of the reservoir is so shallow, floating nets are capable of sampling the entire water column. At the deeper north end, a floating net and a sinking net were required to sample pelagic and benthic areas, respectively. Captured fish were removed from the nets, separated by species, measured, weighed, enumerated, and released.

Population Estimates

Electrofishing from a driftboat mounted mobile anode system (Figure 4) is the principle method used to capture Madison River trout for population estimates (Figure 5). Fish captured for population estimates are weighed and measured, marked with a fin clip, and released. A log-likelihood statistical analysis (MFWP 1997b) is used to estimate trout populations in several sections of the Madison River (Figure 5). Yearling fish are distinguished from two year old & older fish by taking a scale sample from up to ten of each species per half-inch group, making an impression of the scale in acetate, projecting the impression on a microfiche reader, and interpreting the age of the fish from the scale impression. Generally, the number of two year old & older fish is a better indicator of year class strength and subsequent reproductive potential. Yearling numbers serve as an after-the-fact measure of the impact of whirling disease on reproductive success the previous year. Because aging is not complete for 2000 & 2001 estimates, fish from 5.0 to 9.9 inches are used to estimate yearling abundance, and fish larger than 9.9 inches are assumed to be two-year-old & older for those years. The actual estimates may change after aging is completed.

Whirling Disease

Whirling disease (WD) (*Myxobolus cerebralis*) monitoring and research were continued in the Madison River in 2001, though drought conditions prevented planned extensive field studies from being conducted. As designed, the planned studies would have manipulated flow in side channels to simultaneously expose side-by-side cages of sentinel fish to high and low volumes of water to test the theory that water volume is a critical variable in determining the rate and severity of whirling disease infection. Instead, sentinel fish were placed in a trough and given a two hour exposure to various dilutions of whirling disease spores (TAMS), using water from a spring at the head of the South Slide side channel and the mainstem river (Figure 6).

Sentinel fish live-cage studies were again conducted in the Madison River at established sites. Cages containing 60 young-of-the-year rainbow trout were placed at selected locations for multiple 10-day periods to conduct time-series tests. The time-series tests were conducted at the Kirby site from mid-April through mid-July.

Results of the 10-day migration study conducted in 2000 were not available until mid 2001, therefore, not available for the 2000 Annual Report. In that study, five sentinel cages each containing young-of-the-year rainbow trout were used to move fry downstream in an effort to

Figure 4. Electrofishing (shocking) in the Norris section of the Madison River.

mimic migration (MFWP 2001). Fifty fish from each cage were examined for whirling disease infection. The initial exposure of all five cages to river water was at a site that had routinely shown low infection severity. This site served as the control for the experiment due to its history of low infection severity. During the experiment, water temperature fluctuated daily from 52°F – 66°F, and discharge at the USGS Kirby gauge ranged from 1,080 – 1,240 cfs.

Temperature Monitoring

Water temperature was recorded at 14 sites and air temperature at seven sites throughout the course of the Madison River from above Hebgen Reservoir to the mouth of the Madison River at Headwaters State Park (Figure 7). Optic StowAway temperature loggers recorded temperature every 30 minutes, in Fahrenheit. Air temperature recorders were placed in areas that were shaded 24 hours per day. Intensive monitoring is conducted to corroborate previous modeling, to continue building the data set for the model, and to monitor the effectiveness of measures designed to reduce high temperature impacts to aquatic life.

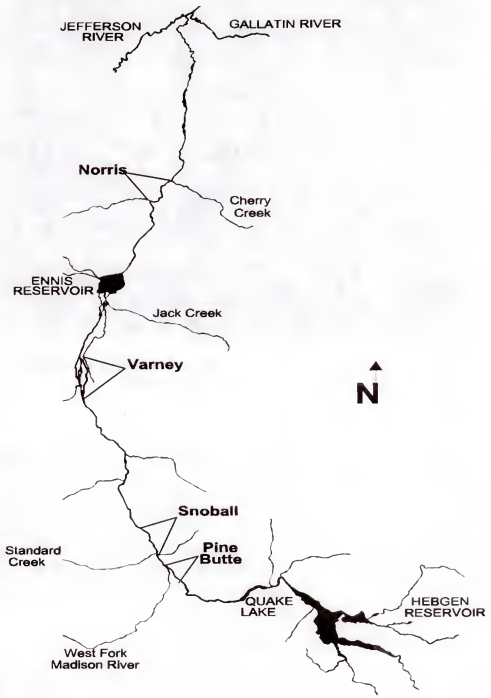

Figure 5. Locations of Montana Fish, Wildlife, & Parks 2001 Madison River population estimate sections.

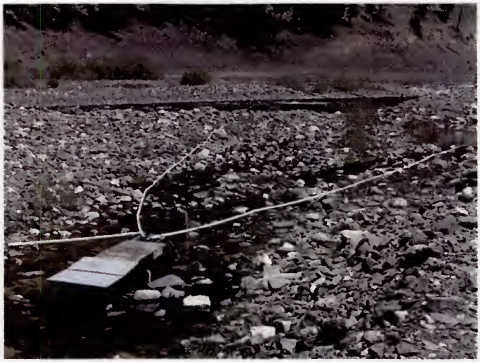

Figure 6. Trough system used to expose sentinel rainbow trout to various concentrations of Whirling Disease TAMS at the South Slide side channel in 2001.

Biological and Biocontaminant Monitoring

As part of its relicensing effort, PPL Montana initiated a water-quality monitoring program in 1994. In this program, personnel of PPL Montana and several agencies, including MFWP, conducted biological and biocontaminant monitoring collections at locations within the Madison/Missouri System. Aquatic invertebrate and periphyton samples are collected for biological trend monitoring and contaminant analyses at eight sites from the Madison River within Yellowstone National Park (YNP) to the Missouri River below Morony Dam at Great Falls, and at three additional sites in the Madison River as part of a flushing flow study. Samples are analyzed by a variety of consultants, and results reported to the PPL Montana Environmental Division.

Westslope Cutthroat Trout Conservation and Restoration

Efforts to conserve and restore genetically pure westslope cutthroat trout in the Madison Drainage center on maintaining high quality stream habitat in Madison River tributaries, adequate instream flow, and removal of competing or hybridizing non-native trout where necessary. Stream habitat surveys were conducted throughout much of the Madison Drainage from 1997 – 1999 (MFWP 1998, Sloat et al. 2000) using techniques modified from Overton et al. (1997). Backpack electrofishing was used to survey fish species. Removal of non-native species will require use of the pesticides rotenone or antimycin.

The Cherry Creek Native Fish Introduction Project, originally scheduled to begin in 1998, remained delayed due to continuing legal challenges. Requests for Summary Judgment were submitted in 2001, though no action was taken by the district court in 2001.

Figure 7. Locations of Montana Fish, Wildlife, & Parks 2001 temperature monitoring sites. Air temperature sites are italicized.

Assisted by personnel from the Sun Ranch, LLC, and the Gallatin National Forest, MFWP collected gametes from wild cutthroat trout in Papoose Creek and the upper portion of the Middle Fork of Cabin Creek. Adult fish were spawned on site and the fertilized eggs transported to a hatchery facility provided by the Sun Ranch. Tissue samples were collected from adult fish for genetic analyses. Individual parental crossings were held separately until results of genetic sampling were available.

Hebgen Reservoir Creel Census

A creel census was conducted on Hebgen Reservoir in from June 2000 – June 2001. Standard creel methods were used to count anglers and census fish. A summary report is in preparation.

Tributary Enhancement

Discharge measurements were conducted at two points on Indian Creek to determine the volume of water necessary to maintain viable fish habitat. Standard USGS methodology for measuring streamflow was used. All measurements were taken downstream of irrigation withdrawal sites, which are just below the mouth of Indian Creek Canyon in the Madison Mountain Range. In most years, Indian Creek goes dry before reaching the Madison River, due in part to irrigation withdrawal, and in part to natural percolation of water into the bench over which Indian Creek flows.

RESULTS AND DISCUSSION

Madison Grayling

Beach seining in Ennis Reservoir was conducted in late August. No young-of-the-year Arctic grayling, whitefish (*Prosopium williamsoni*), rainbow trout (*Oncorhynchus mykiss*), or brown trout (*Salmo trutta*) were captured. Several hundred young-of-the-year white sucker (*Catostomus commersoni*), longnosed sucker (*Catostomus catostomus*), and Utah chub (*Gila atraria*) were captured. Site descriptions, dates, and catches are listed in Appendix A. Ennis Reservoir elevation was down due to drought (4839.20 asl), so the south end was too shallow for the boat to access to conduct seining.

In 2000, MFWP initiated a four-year program to restore fluvial Arctic grayling in the Missouri Headwaters area, including the lower Madison River from Greycliff to the Jefferson River confluence. Twenty-five thousand yearling fluvial Arctic grayling were introduced into the Headwaters area in 2000. In 2001, 28,900 young-of-the-year fluvial Arctic grayling were introduced because hatchery space was not available to overwinter them to yearlings (Magee pers.comm. 2002). Other introduction sites include the lower Beaverhead River, the upper Ruby River, and the North and South forks of the Sun River.

Gillnetting

Results of 2001 gillnetting are presented in Table 1. As in previous years, few rainbow or brown trout were captured.

Table 1. Summary of August 2001 gillnet catch in Ennis Reservoir. Length is in inches, weight is in pounds.

	UC[1]	Wsu	Rb	LL	AG
Avg.length	10.2	12.4	15.4	16.3	13.2
Avg.weight	0.6	1.1	1.5	1.8	0.9
Number sampled	135	74	7	40	2

[1] UC = Utah Chub; Wsu = White Sucker; Rb = rainbow trout; LL = brown trout; AG = Arctic grayling

Population Estimates

Population estimates were conducted in the Norris section in March and in the Pine Butte, Snoball, and Varney sections in September (Figure 5). Until age sample analyses are complete, estimates are provisional.

In the charts illustrating annual population trends, stacked bars represent yearling and age 2 & older classes, with the top of the combined bars depicting the total population. Because Norris estimates are conducted in March each year, yearling fish are too small to capture in adequate numbers to derive an estimate of their abundance.

Figures 8-11 illustrate historic population levels of rainbow trout per mile. Rainbow trout numbers in the upper river were at moderate levels in 2001. In Pine Butte and Varney, the 2001 yearling cohort is the weakest in three years, but is than stronger than any seen from 1990 through 1998. Numbers of adult rainbow trout in Pine Butte and Varney were at moderate levels. Rainbow trout in the Norris section below Ennis Reservoir increased markedly in abundance, and were at the highest level since 1988.

Brown trout numbers per mile are illustrated in Figures 12-15. In the upper river in 2001, two-year-old and older brown trout remain abundant, and yearling numbers are strong. Brown trout numbers in the Norris section below Ennis Reservoir remained similar to those seen in recent years.

Appendix B contains historic population levels of two year old & older rainbow and brown trout (+ 80% C.I.) for each section.

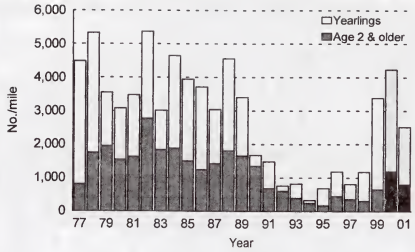

Figure 8. Rainbow trout populations in the Pine Butte section of the Madison River, 1977-2001, fall estimates. Data for 2000 & 2001 are provisional pending completion of age samples.

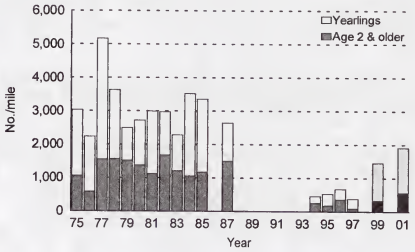

Figure 9. Rainbow trout populations in the Snoball section of the Madison River, 1975-2001, fall estimates. Data for 1999 & 2001 are provisional pending completion of age samples.

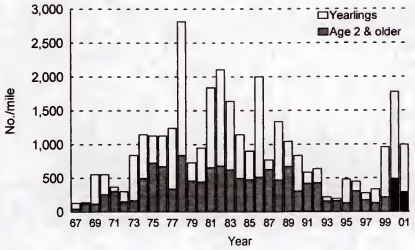

Figure 10. Rainbow trout populations in the Varney section of the Madison River, 1967-2001, fall estimates. Data for 2000 & 2001 are provisional pending completion of age samples.

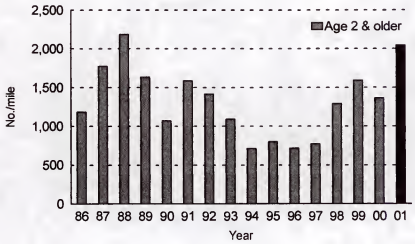

Figure 11. Rainbow trout populations in the Norris section of the Madison River, 1986-2001, spring estimates. Data for 2001 are provisional pending completion of age samples.

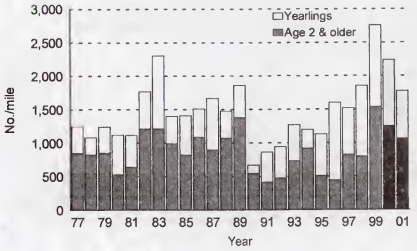

Figure 12. Brown trout populations in the Pine Butte section of the Madison River, 1977-2001, fall estimates. Data for 2000 & 2001 are provisional pending completion of age samples.

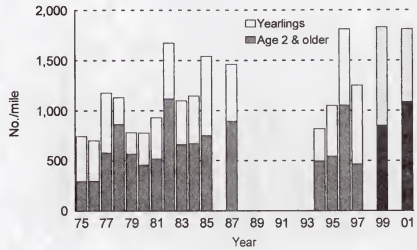

Figure 13. Brown trout populations in the Snoball section of the Madison River, 1975-2001, fall estimates. Data for 1999 & 2001 are provisional pending completion of age samples.

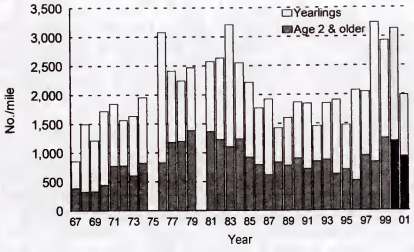

Figure14. Brown trout populations in the Varney section of the Madison River, 1967-2001, fall estimates. Data for 2000 & 2001 are provisional pending completion of age samples.

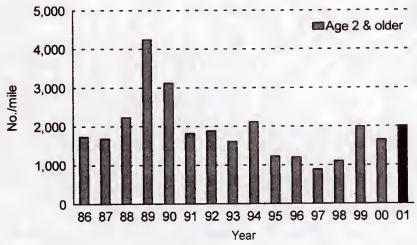

Figure 15. Brown trout populations in the Norris section of the Madison River, 1986-2001, spring estimates. Data for 2001 are provisional pending completion of age samples.

Whirling Disease

Results of 2001 sentinel fish studies are not yet available, including sentinel fish used in the two hour trough exposures.

Results of a rainbow trout fry migration study conducted in 2000 are in Appendix C. Analyses of whirling disease infection were not completed until late 2001, so were unavailable for the 2000 Annual Report. Due to the high incidence of whirling disease throughout the river in 2000, including at the control exposure site, all fry in the experiment suffered extremely high infection severity (Appendix C.)

Sentinel fish data collected over several years indicates that volume of runoff from approximately mid-June through mid-July may be a significant factor in determining severity of whirling disease infection (Vincent, pers.comm. 2000) (Table 2). Regardless of discharge, which ranged from 1095 to 4300 cfs for the 10-day periods examined, average water temperatures ranged from 52°-60° F, which are within or near the optimal range of 52°-56° F for WD production. During those same 10-day periods, when average runoff was 3100 cfs or greater, the highest average infection severity of sentinel fish was 2.40. When average runoff was less than 3100 cfs, average infection severity ranged between 2.74 – 4.16. Severity of 2.50 and higher has been determined to be the approximate point at which growth of individual fish is interrupted and population impacts occur (MFWP 1999).

Table 2. Average discharge in cfs (Q), average water temperature (F), and average infection severity (I) of sentinel young-of-the-year rainbow trout at Kirby during three 10-day periods, 1997-2000. Data are from Vincent, pers.comm. 2000.

	1997			1998			1999			2000		
Date	Q	F	I	Q	F	I	Q	F	I	Q	F	I
6/15-6/25	4300	54.9	2.40	2851	51.9	3.06	3130	52.6	1.96	1547	53.8	3.60
6/25-7/5	2450	57.7	3.41	3378	55.4	2.00	2631	54.4	3.02	1224	57.9	4.16
7/5–7/15	1751	59.5	3.02	2504	57.5	2.74	1984	58.9	2.18	1095	60.3	4.16

Temperature Monitoring

Optic StowAway temperature recorders were deployed throughout the Madison River to document air and water temperatures (Figure 5). Table 3 summarizes the data collected at each location in 2000, and Appendix D1 contains thermographs for each location. Appendix D2 contains thermographs at selected locations showing the 24-hour diurnal temperature fluctuation of each site around the warmest date of the year.

Table 3. Maximum and minimum temperatures (°F) at selected locations in the Madison River Drainage, 2001. Air and water temperature data were recorded 4/24-10/6 (7944 readings) unless otherwise indicated. Thermographs for each location are in Appendix D1.

	Site	Max	Min
Water	Hebgen inlet	77.90	43.37
	Hebgen discharge	66.28	38.07
	Hebgen-Quake river section	66.03	36.46
	Quake Lake outlet	64.07	38.24
	Kirby Bridge	71.10	36.78
	McAtee Bridge	71.25	35.85
	Ennis Bridge	77.44	38.15
	Ennis Reservoir Inlet	77.22	37.14
	Ennis Dam	73.41	48.51
	Bear Trap Mouth[1/]	75.34	44.39
	Norris	78.72	46.59
	Blacks Ford[1/]	77.35	45.09
	Cobblestone	81.93	43.78
	Headwaters S.P.[2/] (Madison mouth)	NA	43.88
Air	Kirkwood Store	98.25	23.43[4/]
	Slide	99.94	25.96
	Wall Creek HQ	99.38	23.51
	Ennis Fisheries Office	100.43[3/]	23.40[4/]
	Ennis Dam	92.44	24.38
	Norris	94.33	28.96
	Cobblestone	92.08	23.52

[1] Original data loggers were lost, replaced on August 20.
[2] Data logger became dewatered temporarily on May 25 & 26, and completely dewatered from June 27-July 7, and from July 31 – Sept 5.
[3] The maximum temperature detectible by the recorders is approximately 100.4°F
[4] The minimum temperature detectible by the recorders is approximately 23.4°F

Biological and Biocontaminant Monitoring

In 2000, New Zealand Mudsnails (NZMS) (Figure 16) were detected below Hebgen Reservoir and Quake Lake, as far downstream as Raynolds Pass Bridge, and in Darlinton Ditch at the Cobblestone Fishing Access Site on the lower Madison River (Figure 5). NZMS are problematic due to their ability to attain densities of over 500,000/square meter, and subsequently, the potential impacts on other aquatic invertebrates. Because they reproduce by cloning, a single NZMS can initiate a population in previously uninfected waters. Few male NZMS have been sampled in North America since the NZMS were first discovered in 1985 in the Snake River. In the Madison River upstream of Hebgen Reservoir, NZMS have comprised up to 70 percent of all aquatic invertebrates sampled (MFWP 2001a).

The Cobblestone FAS was closed to all public use in an effort to eliminate the inadvertent spread of the NZMS from that location. Preliminary studies by MSU personnel at Darlinton Ditch indicate many functional groups have significantly lower densities in the area the snail has invaded compared to where it hasn't invaded (Cada, pers. comm. 2002). These functional groups include scrapers, scraper-collector gatherers, collector gatherers and collector filterers. Taxa that show significantly lower densities in the presence of the snail include Chironomidae and Baetidae, which show the largest decrease. However, these decreased densities only have been seen in the November 2000 samples, significantly lower densities were not observed in samples collected in June 2001.

Figure 16. New Zealand Mudsnail adults. Photo courtesy of Larry Mayer, Billings.

An Environmental Assessment discussing alternatives designed to control the NZMS in Darlinton Ditch was prepared and released for public review (MFWP 2001b).

After public comment was addressed, a decision was made to proceed with an effort to eradicate NZMS from Darlinton Ditch pending results of bioassays to determine the effectiveness of the chosen molluscicide against NZMS and measures to neutralize the molluscicide (MFWP 2001c).

A single NZMS was found in samples collected in the lower Madison River in 2001, near State Highway 84 bridge (Norris Bridge). Monitoring at this site is being conducted by researchers from EcoAnalysts Inc. to document the expansion of NZMS and their impacts on other aquatic biota (Richards, pers.comm. 2002).

Westslope Cutthroat Trout Conservation and Restoration

The Cherry Creek Native Fish Introduction Project remained in litigation throughout 2001. Litigation was filed in the Montana First Judicial District against the Montana Board of Environmental Review, Montana Department of Environmental Quality, and MFWP, and against the Environmental Protection Agency (EPA) in United States District Court for the District of Montana on October 31, 2000. The litigants withdrew the suit against EPA, and the Board of Environmental Review was dismissed from the state action.

The Sun Ranch, LLC, constructed a small hatchery and a rearing pond for use in the Madison Drainage Westslope Cutthroat Trout Conservation and Restoration Program. The intent of the program is to restore genetically pure westslope cutthroat trout to tributaries of the Madison River by taking gametes from nearby populations and developing a local broodstock. The broodstock will be held in the pond at the Sun Ranch. In the first year of the program, gametes were successfully collected from Papoose Creek and the upper Middle Fork of Cabin Creek for development of a local westslope cutthroat trout broodstock. Papoose Creek fish were found to be hybridized with rainbow trout, and were less than 90 percent westslope cutthroat. Upper MF Cabin Creek fish were found to be 100 percent westslope cutthroat trout. Based on this information, the Papoose Creek eggs and fry were purged from the hatchery. On September 11, the remaining 356 fish were stocked into the Sun Ranch pond.

In November, examination of the hatchery records revealed a record-keeping error that resulted in 105 Papoose Creek fish being labeled as Cabin Creek fish. To prevent the hybrid fish from incorporating into the broodstock, it was determined that all the fish would need to be removed from the pond. It is not possible to distinguish the Papoose Creek fish from the Cabin Creek fish based on appearance or external characteristics, therefore all the fish will have to be removed. An EA was prepared to examine the impacts of the project and to explore alternative methods of removing the fish. Removal of the fish by any capture method was ruled out because of the uncertainty of capturing all the fish in the pond, and inefficiency of these methods. It was determined that use of a fish toxicant was the only feasible method available that would result in complete eradication of the fish in the pond. Fintrol (active ingredient antimycin) was the fish toxicant selected for use in the project and evaluation in the EA. The EA was released for public review and comment on December 21.

A habitat enhancement project was completed in the upper South Fork of the Madison River in 2001 (Appendix E).

Hebgen Reservoir Creel Census

Preliminary analyses of Hebgen Reservoir creel data (Byorth, pers.comm. 2002) indicate that a total of 17,505 angler-days were spent on Hebgen Reservoir from June 2000 - June 2001. Boat anglers accounted for 12,537 angler-days, while shore anglers accounted for 4,968 angler-days. Ice fishermen were counted as shore anglers. The average length of an angler-day for both boat and shore anglers was 3.7 hours. Over 80 percent of the total pressure occurred from May through August. Boat anglers experienced higher catch rates than did shore anglers for all species creeled. Rainbow trout catch rates averaged 0.29/hour and monthly averages ranged from 0.19 – 0.62. Brown trout catch rates averaged 0.09/hour and monthly averages ranged from 0 – 0.75.

Tributary Enhancement

Streamflow measurements conducted on Indian Creek in 2001 show an average loss of about 7 cubic feet/second (cfs) as water travels from the county road bridge at the CB Ranch to the U.S. Highway 287 Bridge (Table 4), a distance of over 3 miles. Additional measurements will be taken in 2002 to further define this relationship, and to determine the volume of water necessary to adequately provide viable fish habitat in this portion of Indian Creek.

FWP has a year-round instream flow right of 48 cubic feet per second (cfs) in Indian Creek, measured at the Highway 287 Bridge. However, the priority date is 1985, so all other water right holders in the Indian Creek basin are senior to FWP.

Table 4. Stream discharge measurements during 2001 in Indian Creek at the county road bridge near the CB Ranch and the U.S. Highway 287 Bridge, and the volume of water lost between the bridges. Al l measurements are in cubic feet per second (cfs).

Date	CB Ranch	US 287	volume lost
4/4	16.8	6.0	10.8
5/25	95.2	91.8	3.4
6/26	39.8	32.6	7.2
7/11	0.8	dry	---

CONCLUSIONS AND FUTURE PLANS

Four tasks were identified for action in 2001: 1) complete the year long creel census on Hebgen Reservoir; 2) determine the feasibility of re-watering selected eastside tributaries of the Madison River by improving irrigation efficiency; 3) conduct field trials of a water management action that potentially may reduce the WD infection severity of young-of-the-year rainbow trout, and 4) determine the importance of the Bypass Reach between Ennis Dam and Powerhouse for spawning trout using radio telemetry. The second and fourth of these were not completed due to unforeseen circumstances that arose – a personnel shortage, and the onset of the NZMS situation in Darlinton Ditch,

which required field studies, production of an EA, and public meetings. Item number 3 was not conducted due to low flows in the Madison River, however, a small-scale effort was made using various combinations of Madison River water and water from a known WD source.

In 2001, stream discharge measurements were initiated on Indian Creek to gather baseline data for determining the quantity of water necessary to provide viable fish habitat. Additional data will be collected in 2002 to assess the feasibility of working with water right holders to improve streamflows for fisheries purposes. If improvements seem feasible, water right holders will be contacted to determine the potential for entering into agreements using TAC and other grant money to improve the efficiency of irrigation systems to reduce ditch loss of irrigation water. If such measures can be implemented, and excess water remains in the stream, an opportunity will be available to enhance or initiate spawning runs in those tributaries, and diversify spawning and rearing sources for the Madison River fishery.

In the Bypass reach of the Madison River between Ennis Dam and powerhouse, radio telemetry will be used to monitor movements of trout to determine their use of the Bypass and how flow fluctuations in the Bypass affect their behavior. Additionally, surveys will be conducted in the Beartrap Canyon to determine the availability and use of spawning gravel. The intent of this work is to determine whether gravel should be added to the Bypass Reach to enhance its suitability for spawning.

Pending the outcome of the Cherry Creek litigation, that project is set to go forth in 2002.

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Appendix A

Description of young-of-the-year Arctic grayling beach seining locations in Ennis Reservoir, and catch at each site. See Figure 2 for sites.

Species abbreviations:

AG	arctic grayling
MWF	mountain whitefish
WSu	white sucker
UC	Utah chub

August 29, 2001

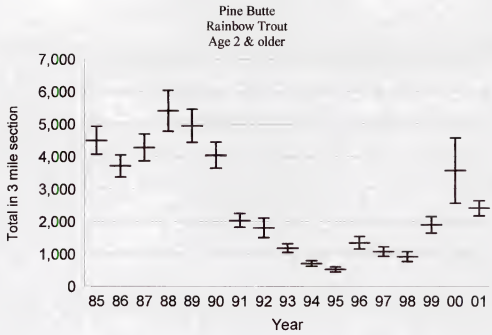
Site and time seined	AG	MWF	Note
parallel to shore along east end of willows at edge of Peterson property ($1000 house) (Fig 2, site 1) 1150 hrs	0	0	One y-o-y WSu; one y-o-y UC Macrophytes abundant throughout Meadow Creek Bay
parallel to shore along west end of willows at edge of Peterson property ($1000 house) (Fig 2, site 1) 1220 hrs	0	0	100's of y-o-y WSu & UC
Meadow Cr. Bay parallel to shore along east end of willows at Meadow Lake FAS (Fig 2, site 1) 1235 hrs	0	0	dozens y-o-y WSu & UC
Meadow Cr. Bay Parallel to shore along west end of willows at Meadow Lake FAS (Fig 2, site 1) 1255 hrs	0	0	100's of y-o-y WSu & UC
Ennis Reservoir elevation was down due to drought (4839.20 asl), so the south end was too shallow for boat to access to conduct seining.			

Appendix B

Population estimates (number for total section) of age 2 & older rainbow and brown trout in the Madison River ± 80 percent Confidence Intervals

section lengths

Pine Butte – 3 miles
Snoball – 4.5 miles
Varney – 4 miles
Norris – 4 miles


Pine Butte
Rainbow Trout
Age 2 & older
Total in 3 mile section
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
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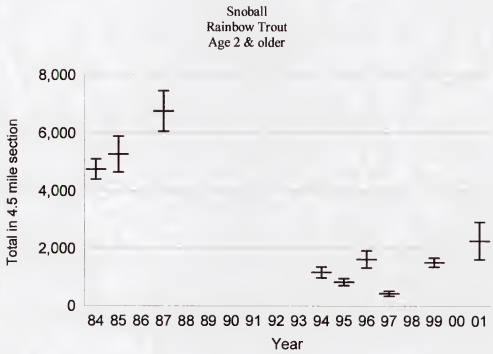
Year


Snoball
Rainbow Trout
Age 2 & older
Total in 4.5 mile section
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6,000
4,000
2,000
0
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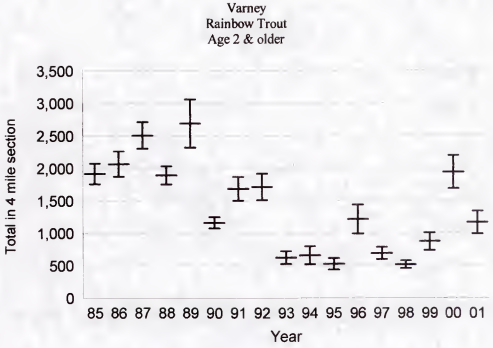
Year


Varney
Rainbow Trout
Age 2 & older
Total in 4 mile section
3,500
3,000
2,500
2,000
1,500
1,000
500
0
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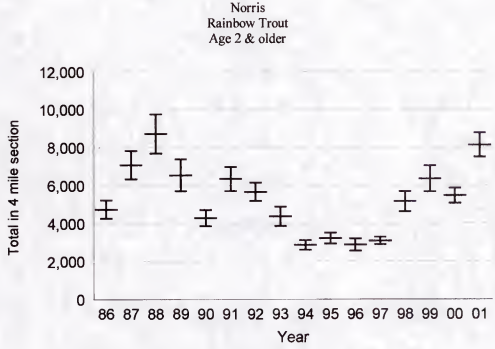
Year


Norris
Rainbow Trout
Age 2 & older
Total in 4 mile section
12,000
10,000
8,000
6,000
4,000
2,000
0
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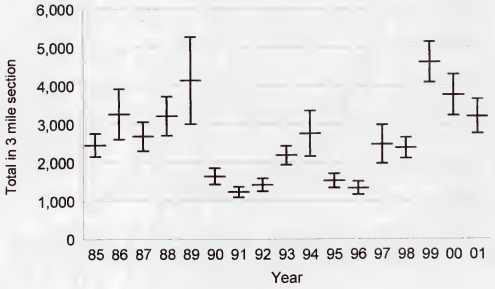
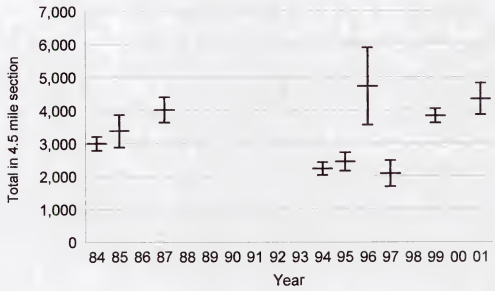
Year

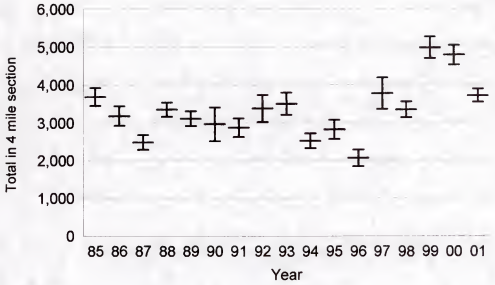
Pine Butte
Brown Trout
Age 2 & older



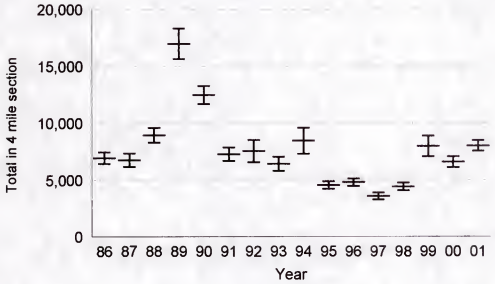
Snoball
Brown Trout
Age 2 & older



Varney
Brown Trout
Age 2 & older



Norris
Brown Trout
Age 2 & older



Appendix C

Rainbow Trout Fry Migration Study
July 2000

Madison River rainbow trout fry migration whirling disease infection study
June 28-July 8, 2000

Fry were taken from Pony in 5 lots in spring water (52° F) in 3 aerated coolers. Upon arrival at Lower North Slide, water temps in the coolers were 52.5°, 52.7°, and 53.2° F. One fish appeared stressed and was excluded from the experiment. After the sentinel cages were secured in the river, each of the 5 lots of study fish were tempered in a bucket with equal portions of cooler water (Pony spring) and river water. Temperature of river water was 59.7° F. Approximately 70-75 study fish and a Tidbit temperature recorder were then placed in each cage. The Tidbit was kept with the fish throughout the 10-days – in sentinel cages and in coolers during transfers between sites and from the river to the lab at Pony. Mortalities were removed from the cages during each move.

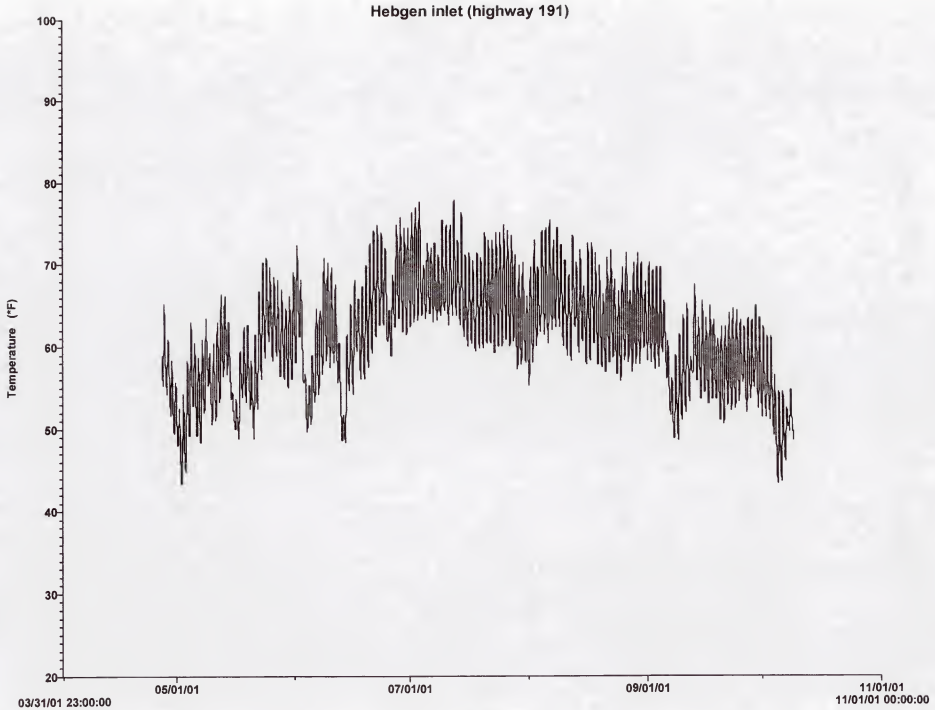
Standard protocol was followed when fish were brought to Pony for rearing to 90-days post exposure.

Water temps, infection rate (%), and average infection grade (MacConnell/Baldwin scale) during 10-day experiment

Site	Start	End (7/8/00)	max temp	min temp	avg temp	infection rate(%)/grade
N Slide (Control)	6/28/00 1700 hrs	17:48:00	65.46	52.28	57.00	98/3.16
Raynolds Bridge		17:32:30	64.59	52.06	57.41	100/4.56
3 Dollar Bridge		17:25:30	65.42	51.22	56.20	100/4.24
Big Bend		17:38:30	65.36	51.16	56.93	100/4.06
Pine Butte		17:57:30	65.73	51.52	57.00	98/3.98

Appendix D1

Temperature recordings from monitoring sites on the Madison River
(See Figure 7 for locations)


Hebgen inlet (highway 191)
Temperature (°F)
100
90
80
70
60
50
40
30
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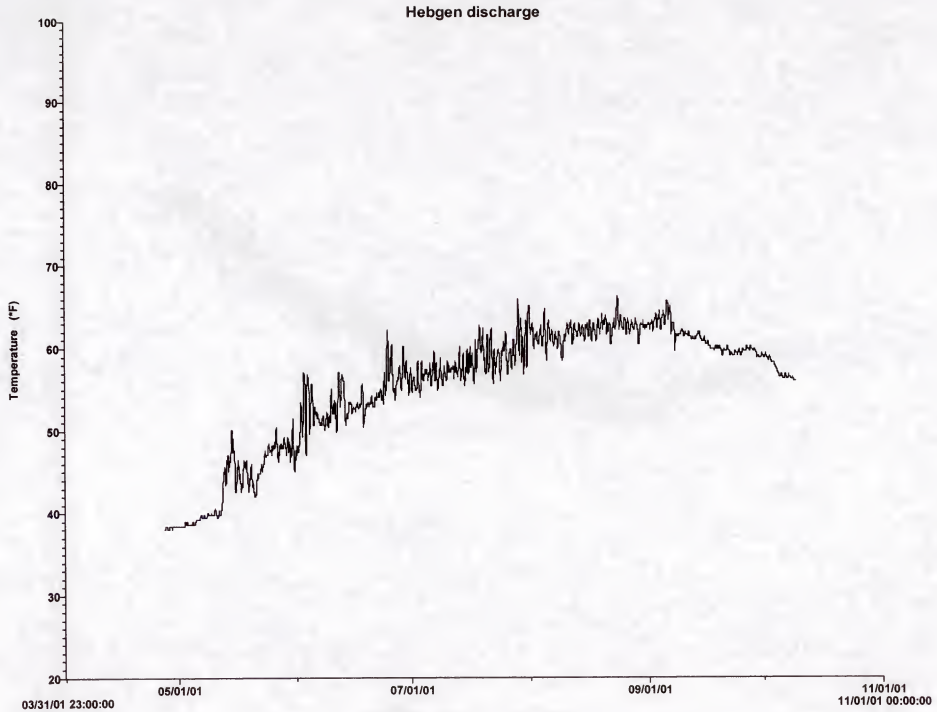
Hebgen discharge
Temperature (°F)
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50
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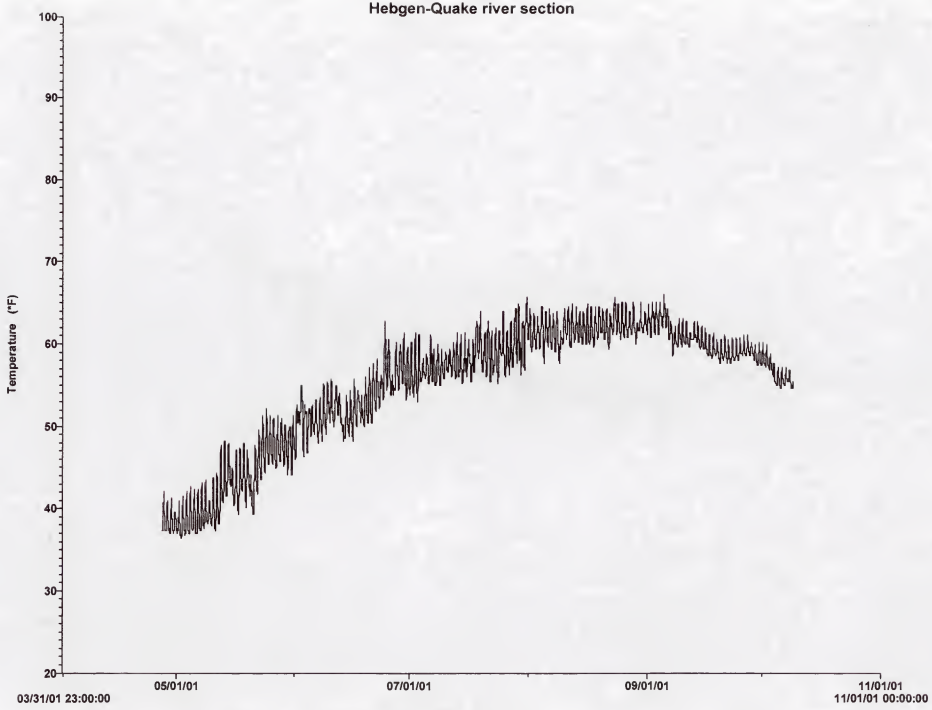
Hebgen-Quake river section
Temperature (°F)
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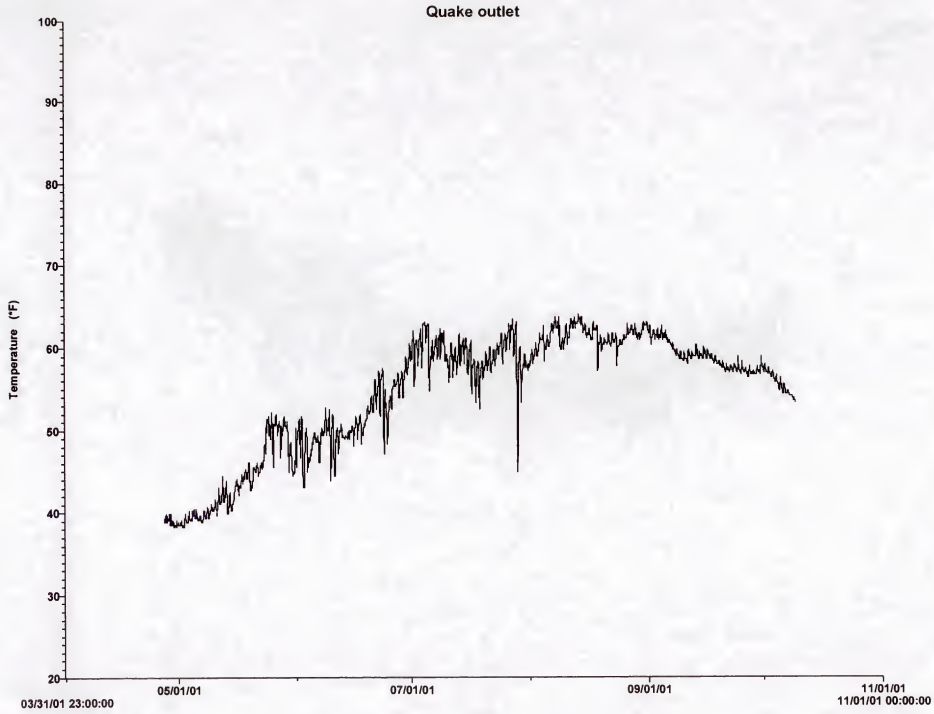
Quake outlet
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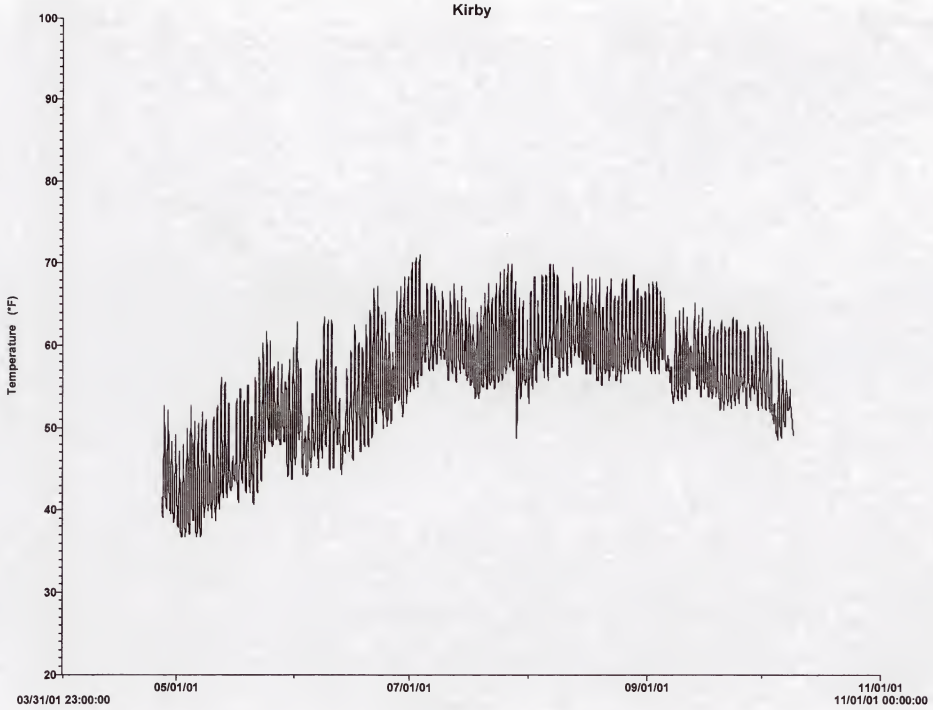
Kirby
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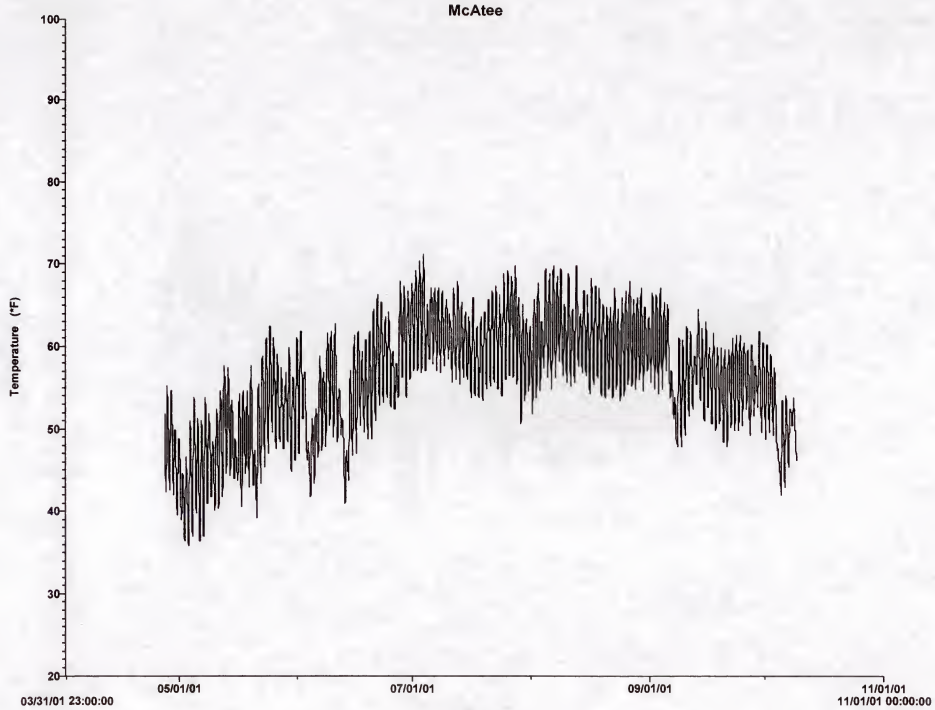
McAtee
Temperature (°F)
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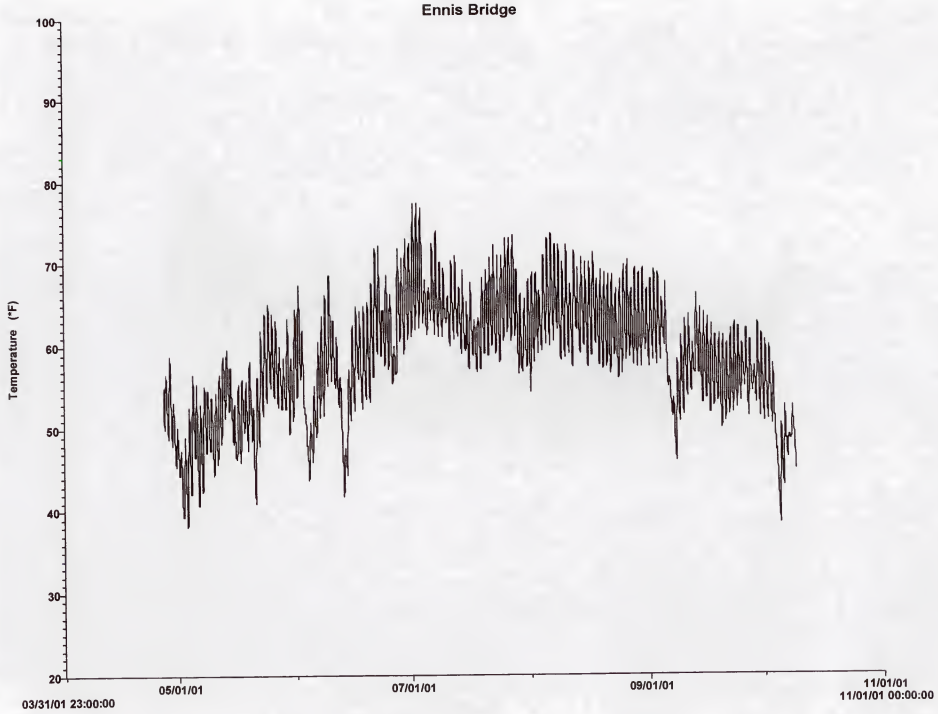
Ennis Bridge
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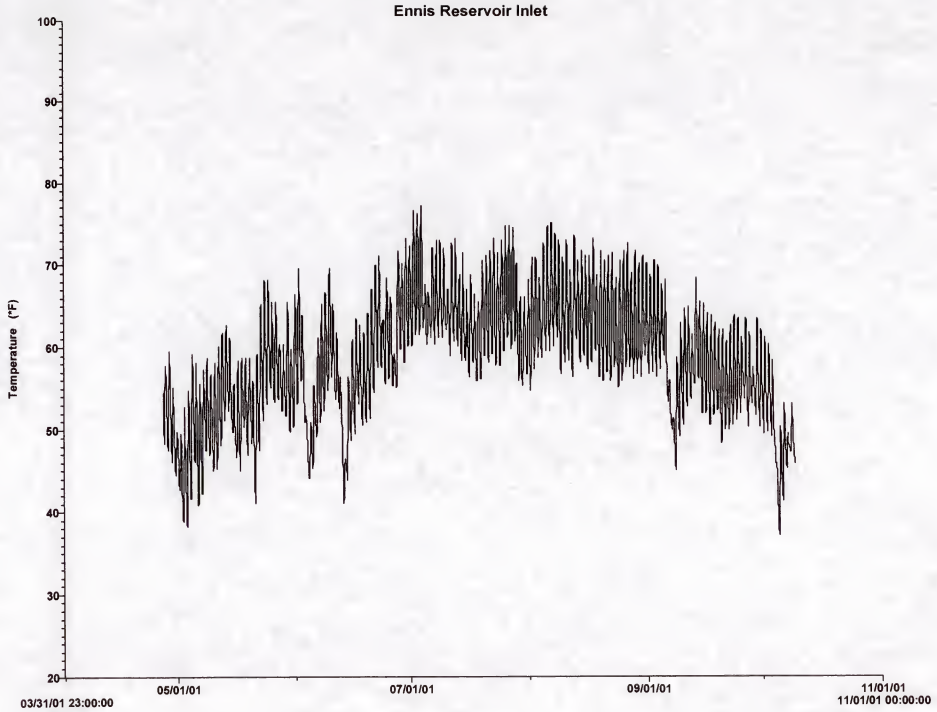
Ennis Reservoir Inlet
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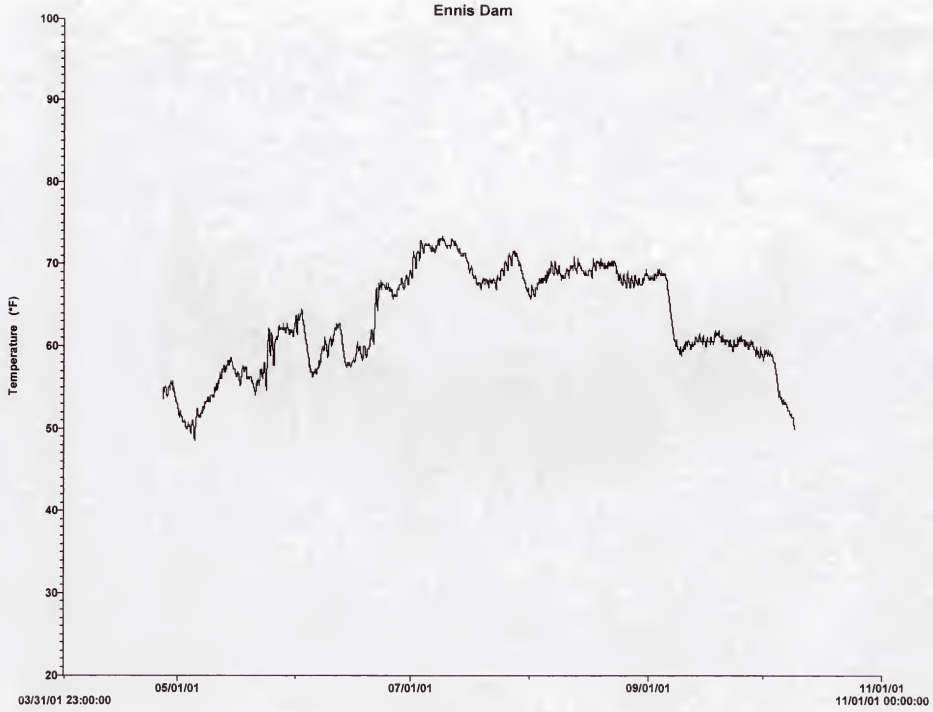
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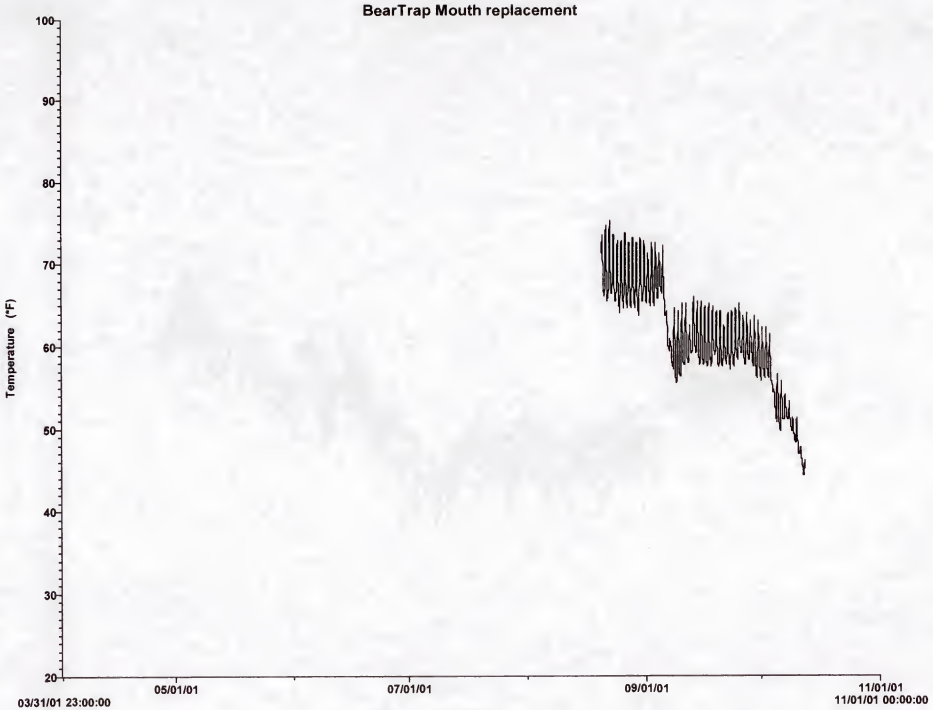
BearTrap Mouth replacement
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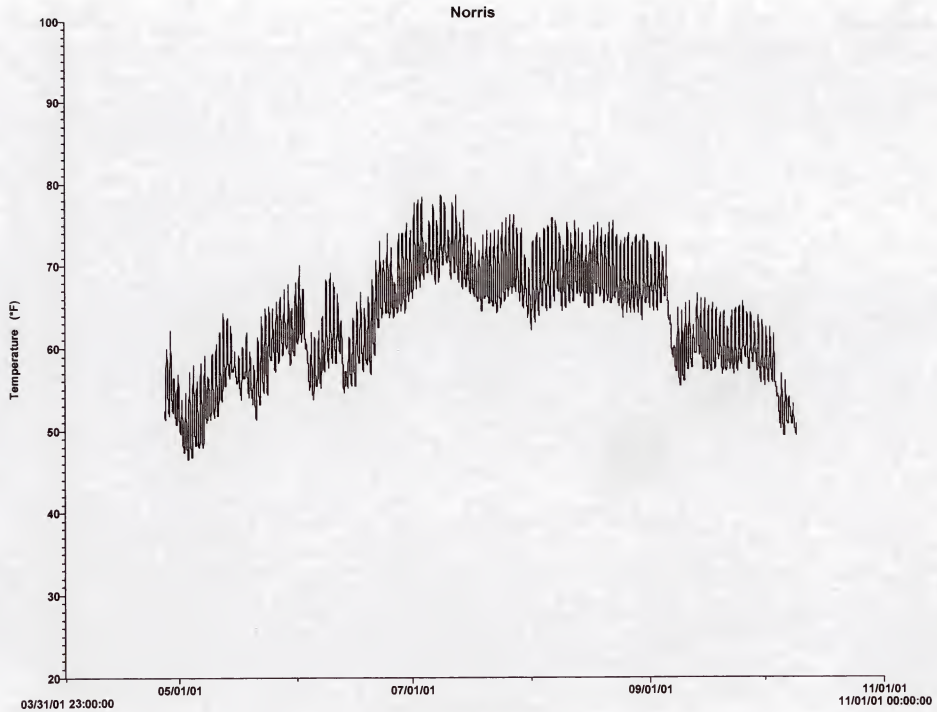
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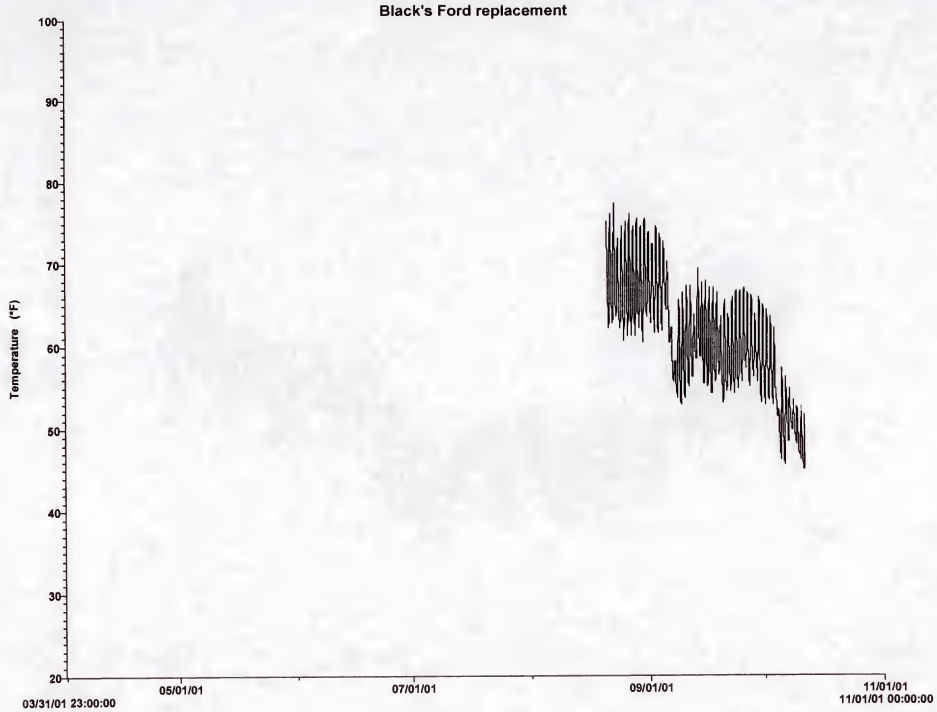
Black's Ford replacement
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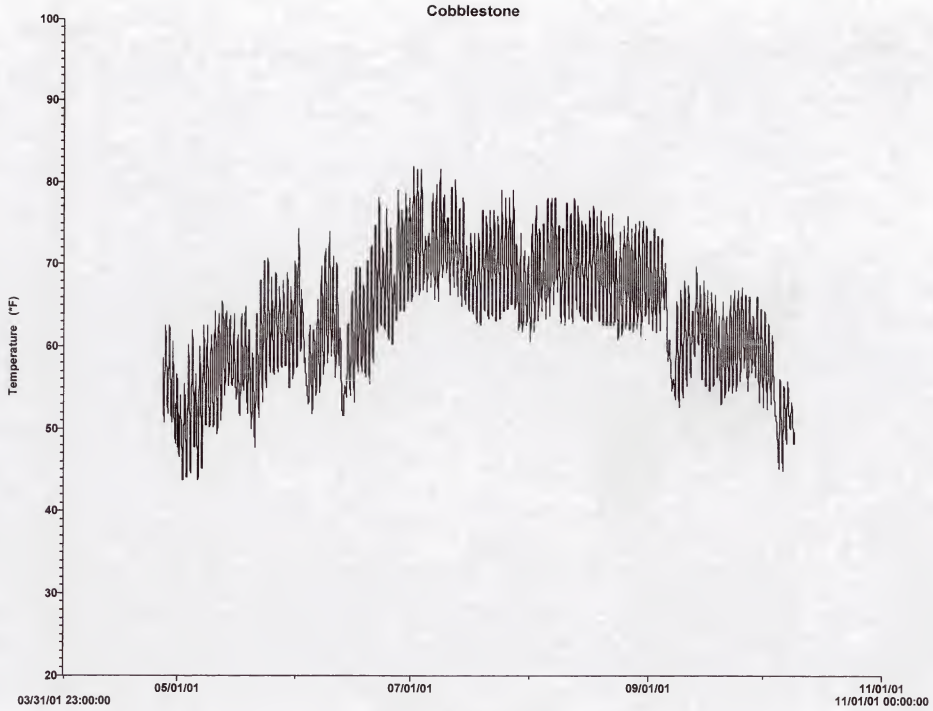
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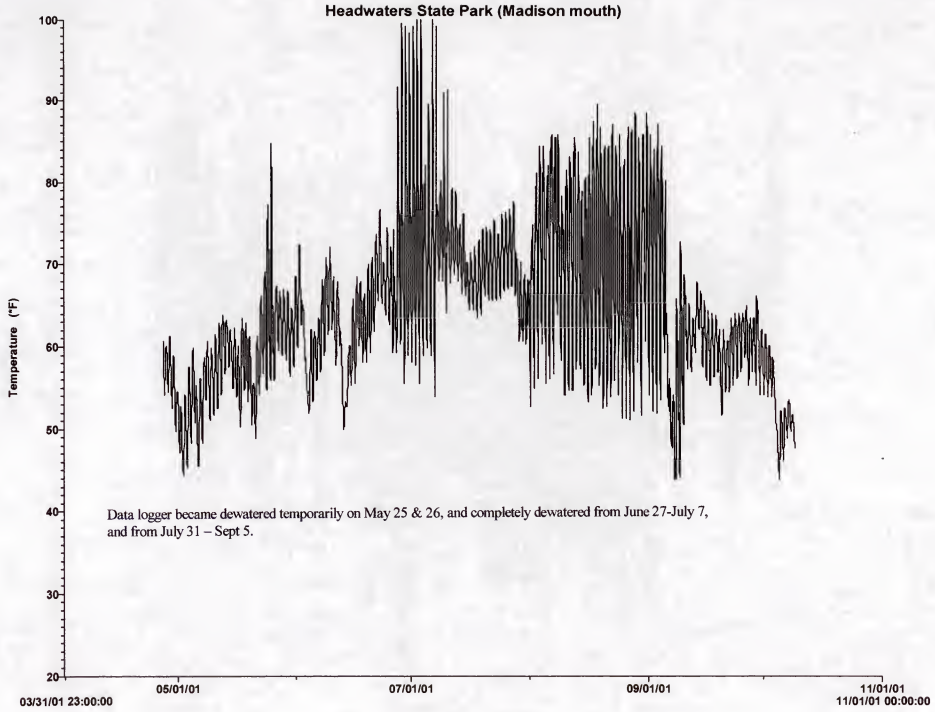

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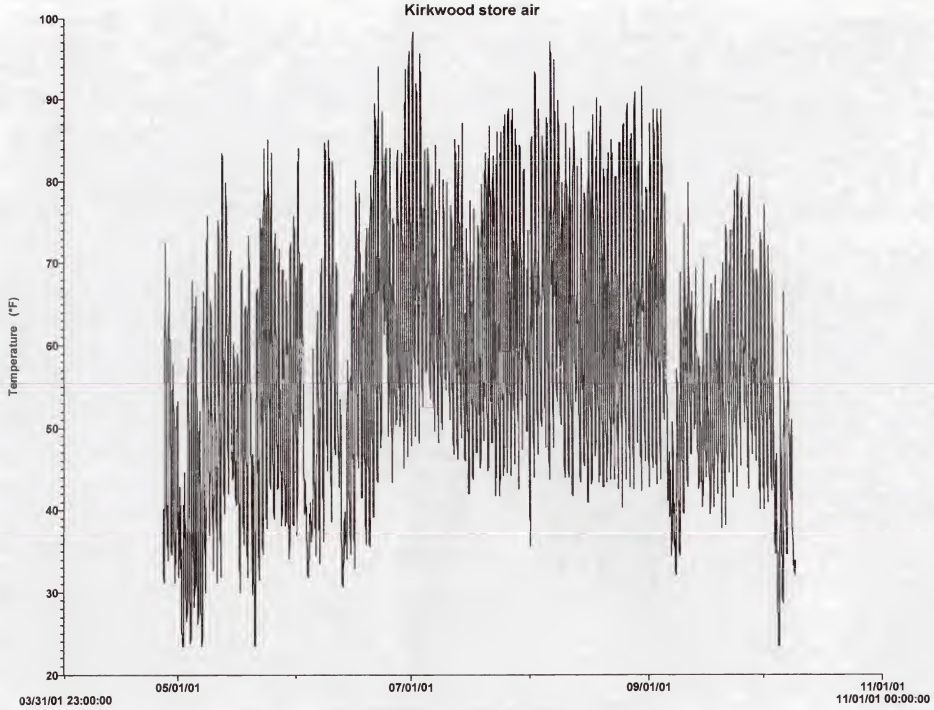
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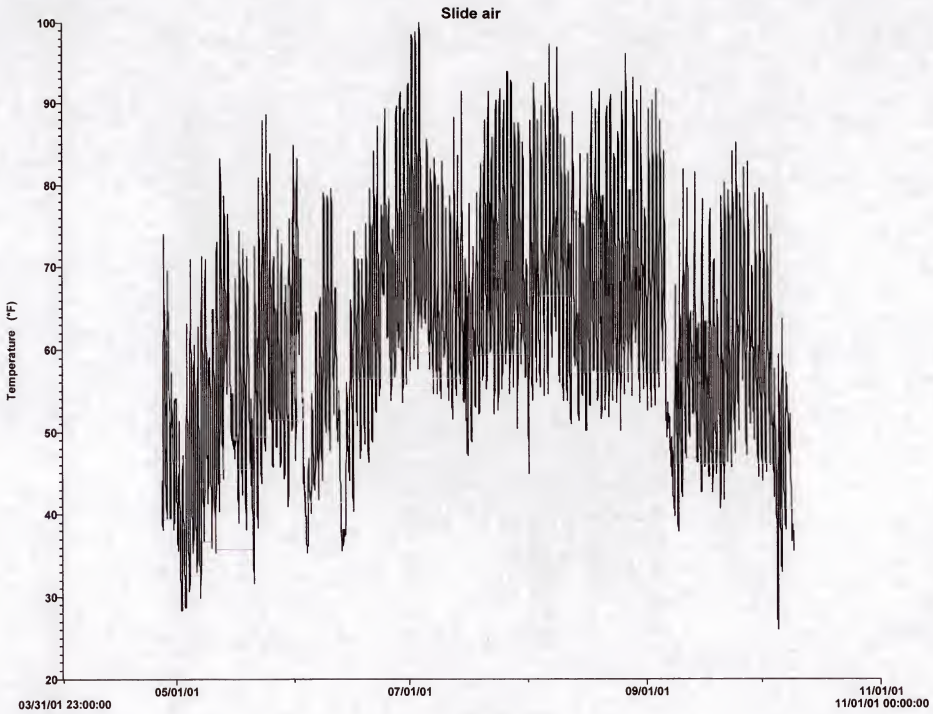
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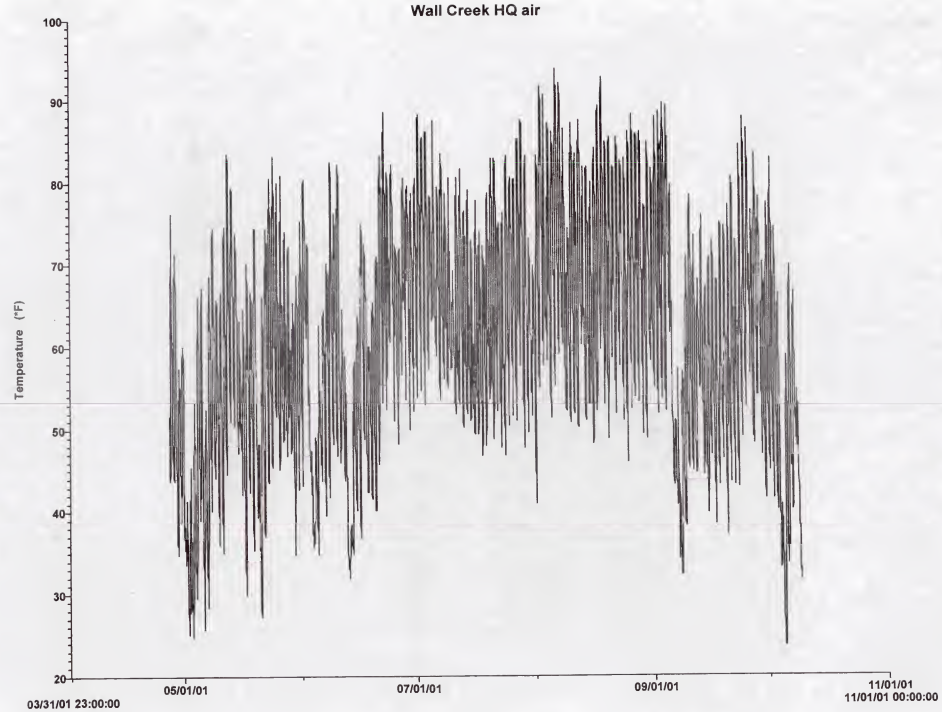
Wall Creek HQ air
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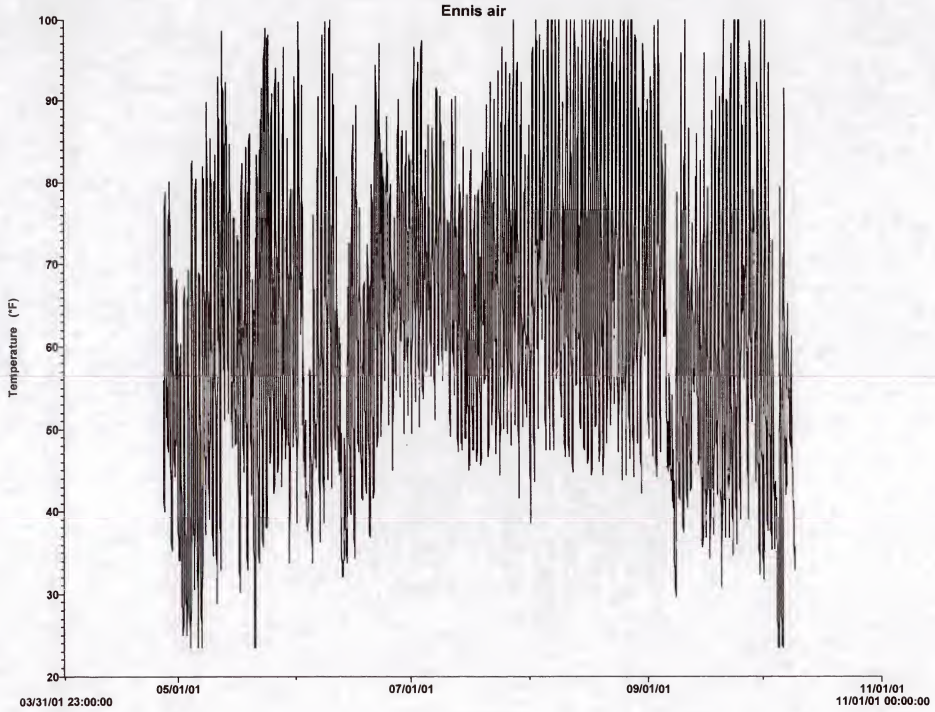
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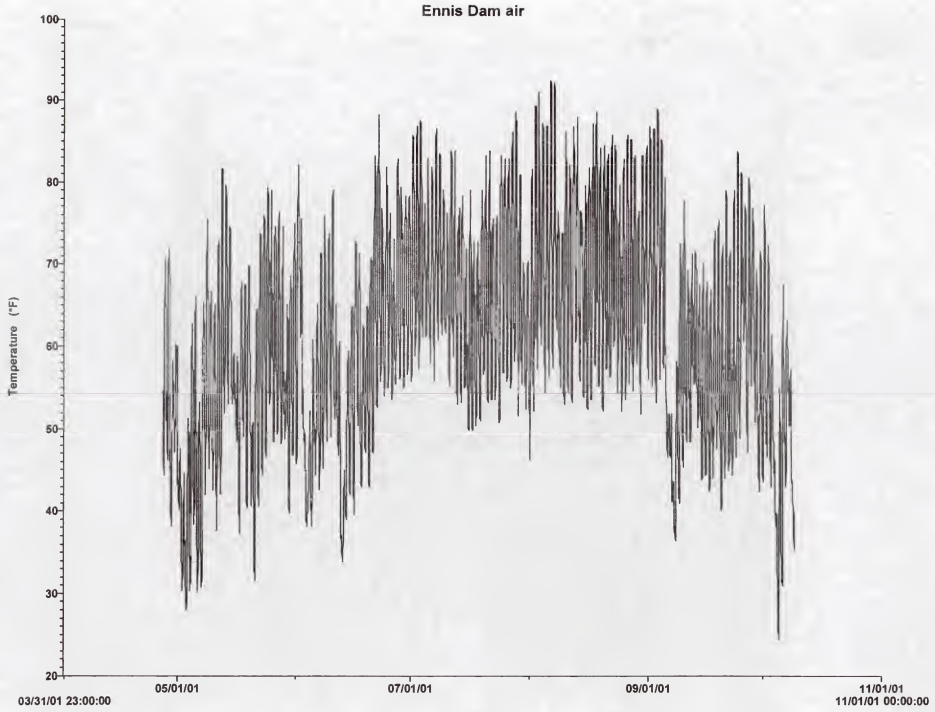
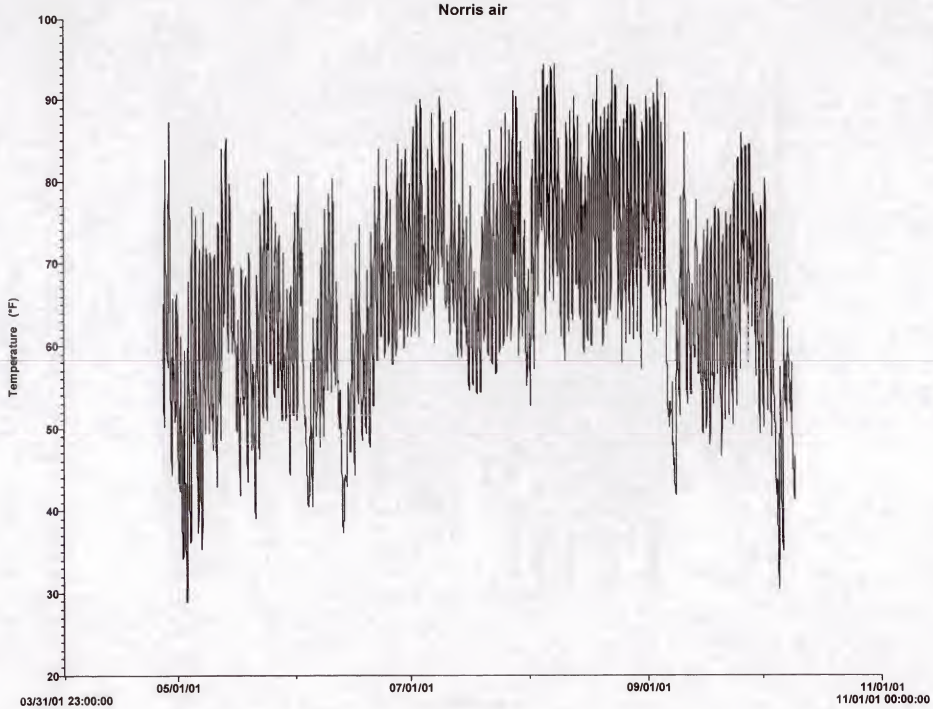
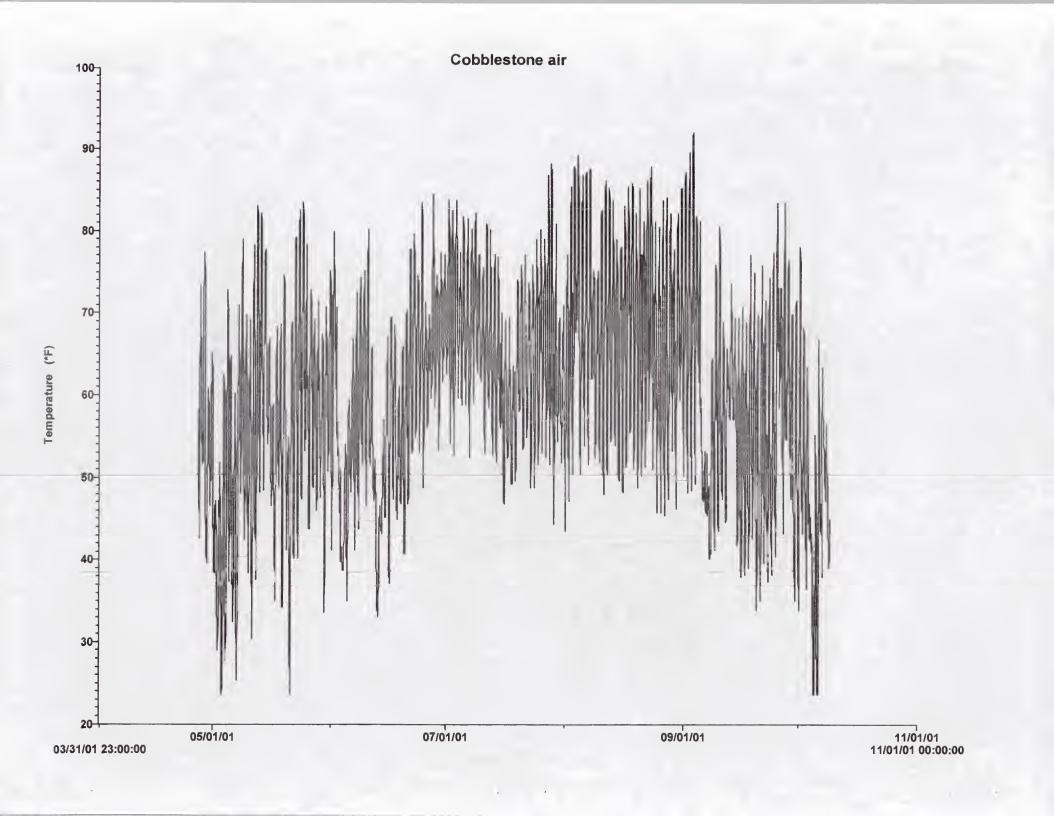
09/01/01
11/01/01
11/01/01 00:00:00

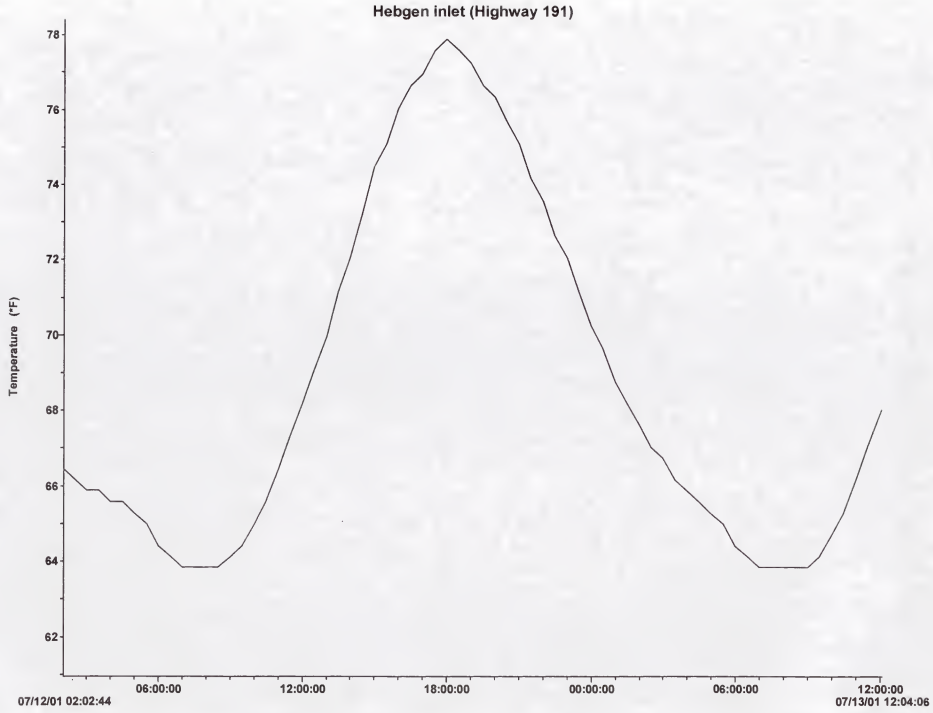

Ennis Dam air
Temperature (°F)
100
90
80
70
60
50
40
30
20
03/31/01 23:00:00
05/01/01
07/01/01
09/01/01
11/01/01
11/01/01 00:00:00

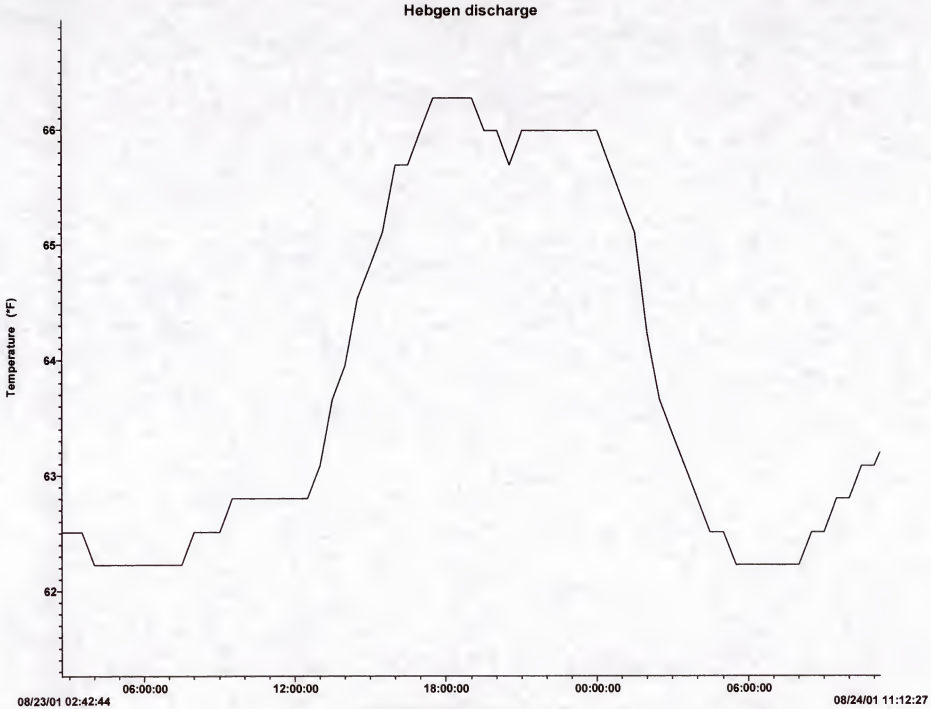

Norris air
Temperature (°F)
100
90
80
70
60
50
40
30
20
03/31/01 23:00:00
05/01/01
07/01/01
09/01/01
11/01/01
11/01/01 00:00:00

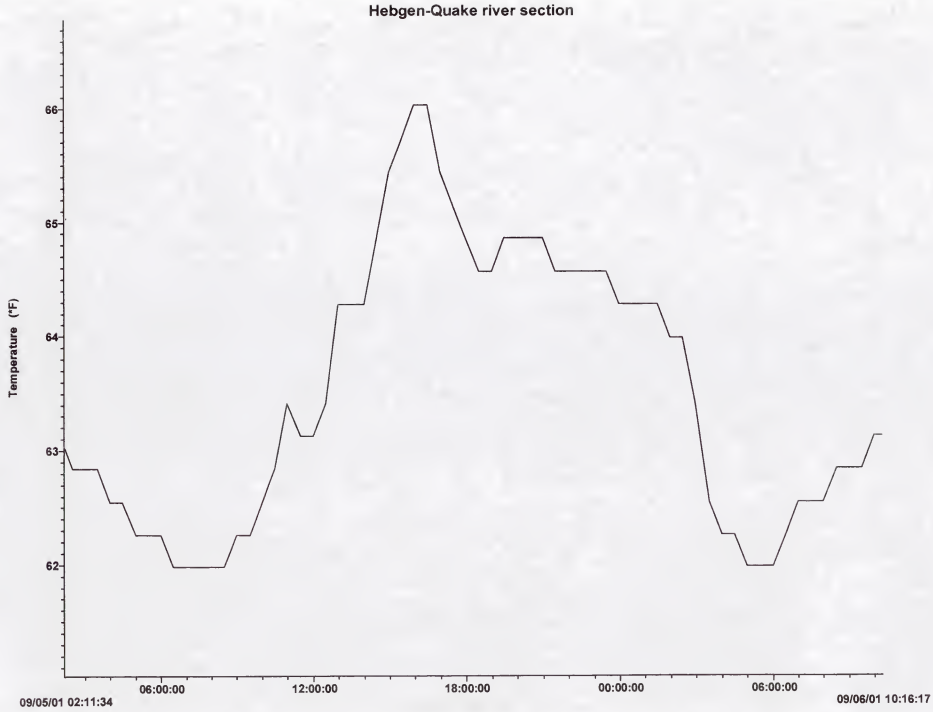

Cobblestone air
Temperature (°F)
100
90
80
70
60
50
40
30
20
03/31/01 23:00:00
05/01/01
07/01/01
09/01/01
11/01/01
11/01/01 00:00:00

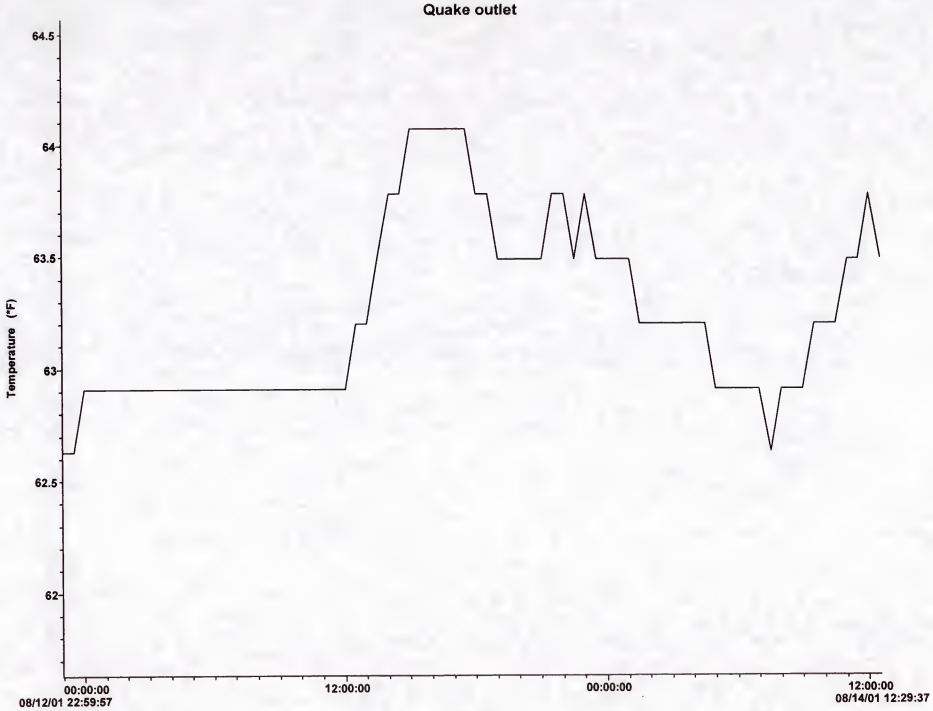
Appendix D2

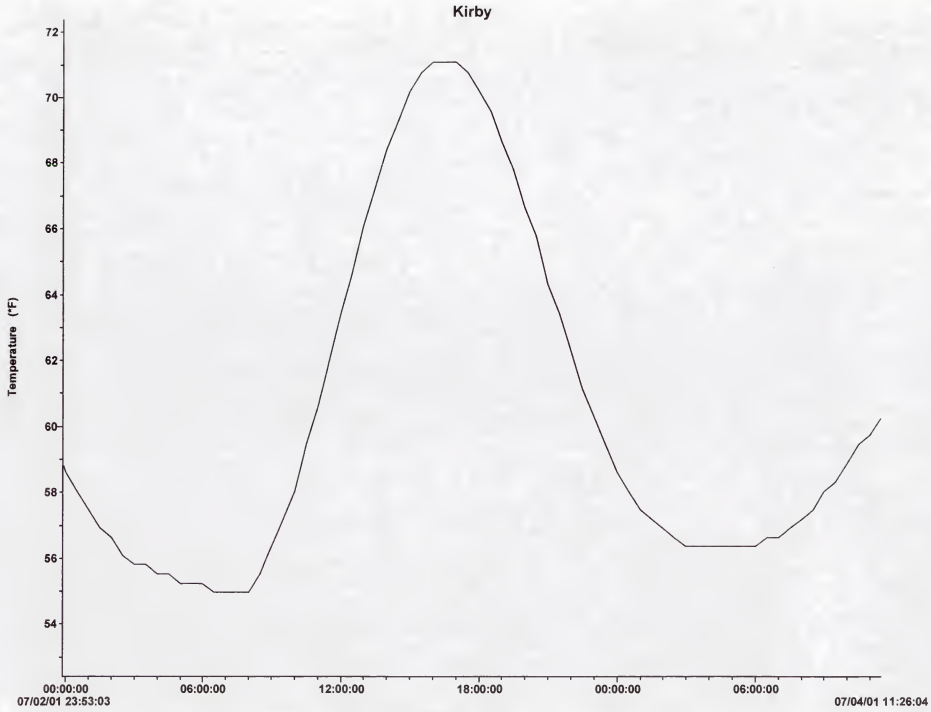
Diel water temperature fluctuations during the warmest 24 hours at selected sites.

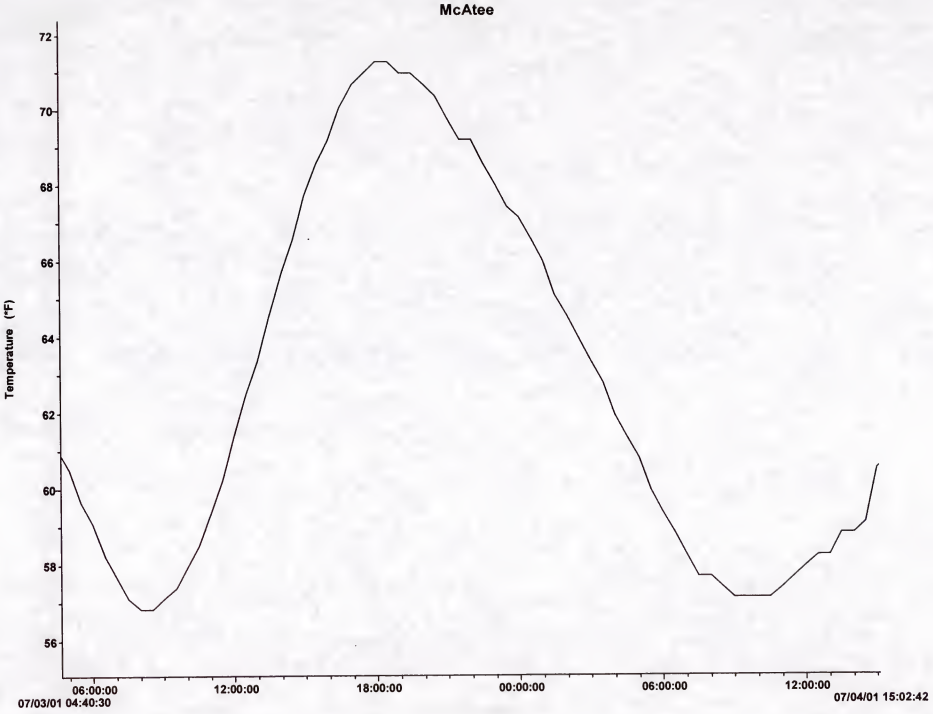

Hebgen inlet (Highway 191)
Temperature (°F)
78
76
74
72
70
68
66
64
62
06:00:00
12:00:00
18:00:00
00:00:00
06:00:00
12:00:00
07/12/01 02:02:44
07/13/01 12:04:06

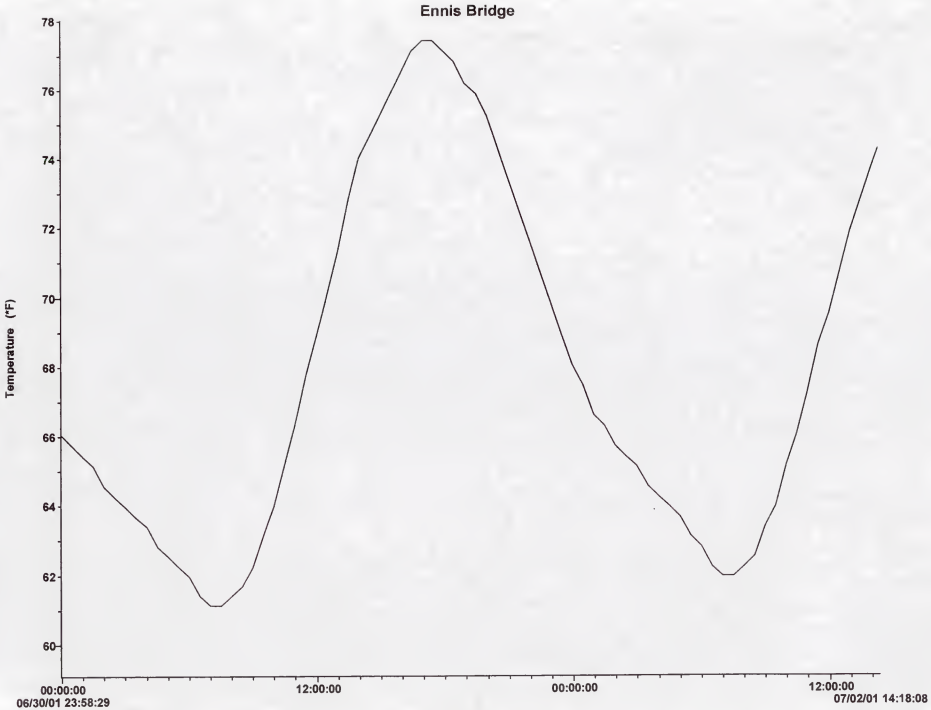

Hebgen discharge
Temperature (°F)
66
65
64
63
62
06:00:00
12:00:00
18:00:00
00:00:00
06:00:00
08/23/01 02:42:44
08/24/01 11:12:27

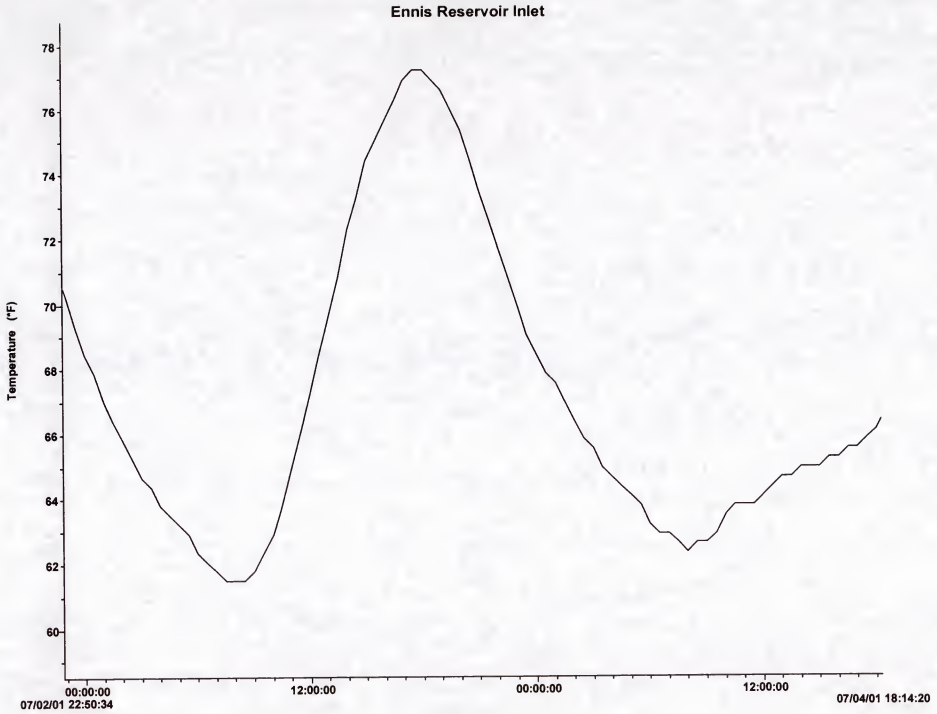

Hebgen-Quake river section
Temperature (°F)
66
65
64
63
62
06:00:00
12:00:00
18:00:00
00:00:00
06:00:00
09/05/01 02:11:34
09/06/01 10:16:17

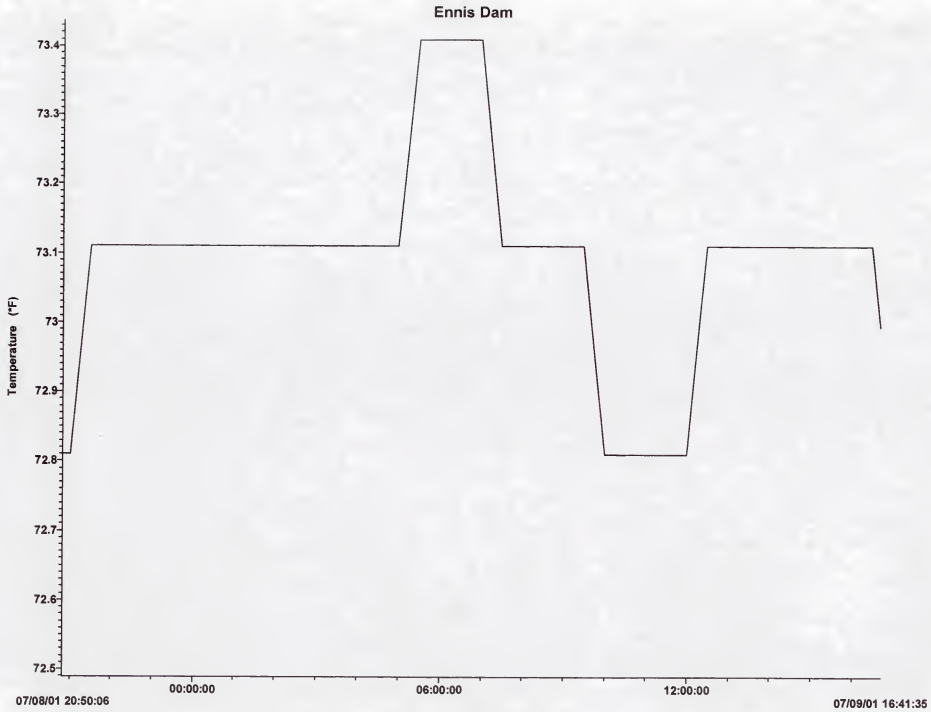

Quake outlet
64.5
64
63.5
63
62.5
62
Temperature (°F)
00:00:00
08/12/01 22:59:57
12:00:00
00:00:00
12:00:00
08/14/01 12:29:37

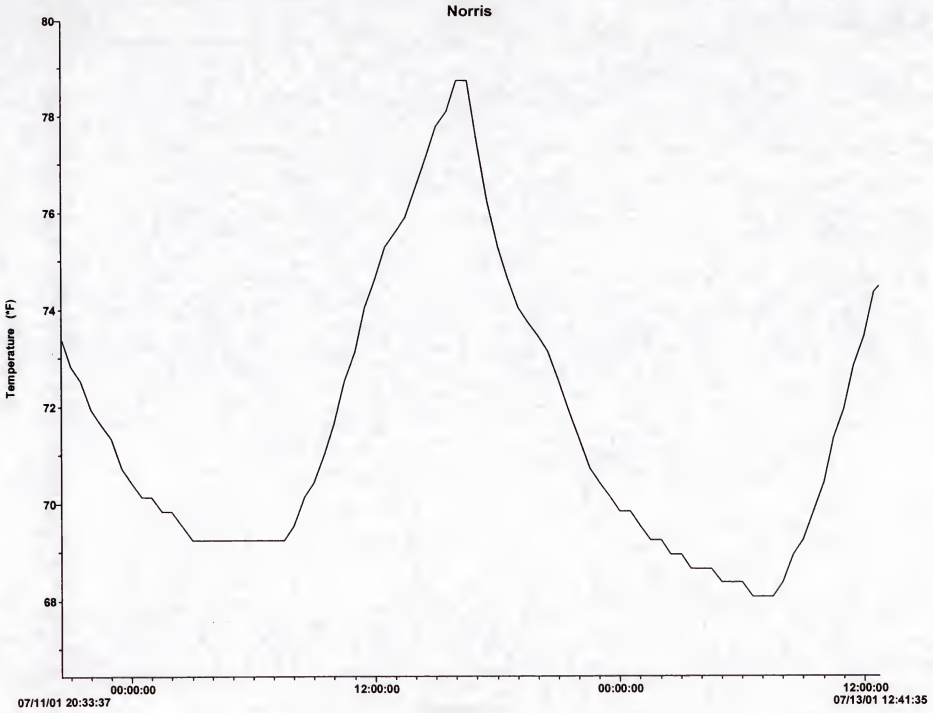

Kirby
Temperature (°F)
72
70
68
66
64
62
60
58
56
54
00:00:00
07/02/01 23:53:03
06:00:00
12:00:00
18:00:00
00:00:00
06:00:00
07/04/01 11:26:04

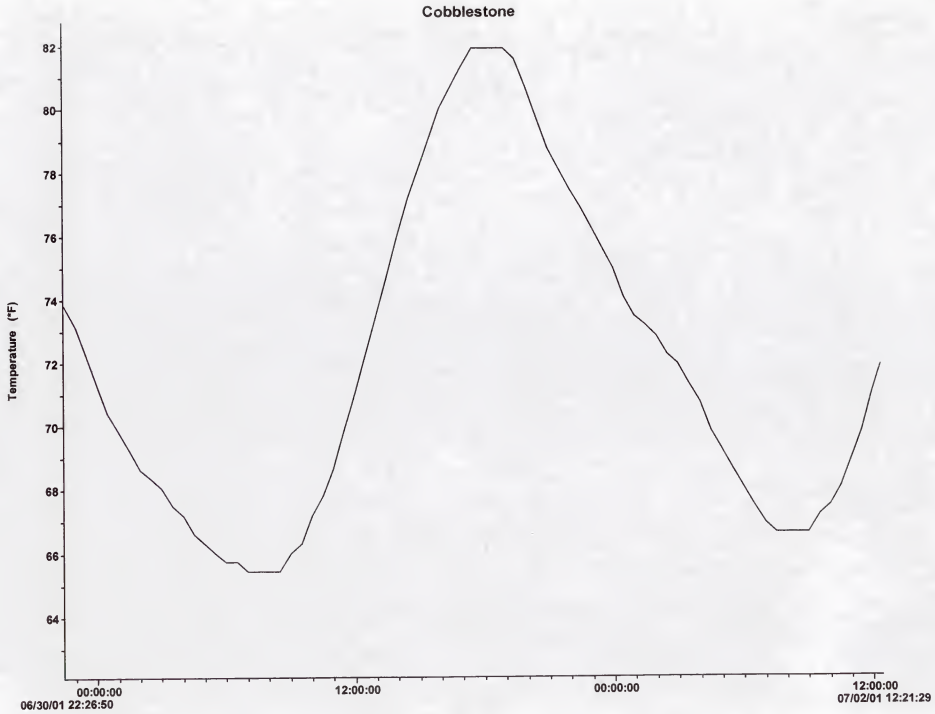

McAtee
Temperature (°F)
72
70
68
66
64
62
60
58
56
06:00:00
07/03/01 04:40:30
12:00:00
18:00:00
00:00:00
06:00:00
12:00:00
07/04/01 15:02:42


Ennis Bridge
Temperature (°F)
78
76
74
72
70
68
66
64
62
60
00:00:00
06/30/01 23:58:29
12:00:00
00:00:00
12:00:00
07/02/01 14:18:08


Ennis Reservoir Inlet
Temperature (°F)
78
76
74
72
70
68
66
64
62
60
00:00:00
07/02/01 22:50:34
12:00:00
00:00:00
12:00:00
07/04/01 18:14:20


Ennis Dam
Temperature (°F)
73.4
73.3
73.2
73.1
73
72.9
72.8
72.7
72.6
72.5
07/08/01 20:50:06
00:00:00
06:00:00
12:00:00
07/09/01 16:41:35


Norris
80
78
76
74
72
70
68
Temperature (°F)
00:00:00
12:00:00
00:00:00
12:00:00
07/11/01 20:33:37
07/13/01 12:41:35


Cobblestone
Temperature (°F)
82
80
78
76
74
72
70
68
66
64
00:00:00
06/30/01 22:26:50
12:00:00
00:00:00
12:00:00
07/02/01 12:21:29

Appendix E

SOUTH FORK MADISON RIVER WESTSLOPE CUTTHROAT TROUT HABITAT RESTORATION PROJECT

Hebgen Lake Ranger District, Gallatin National Forest **Contact: Wally McClure, GNF fish program manager, (406) 527-6711 E-mail** wmcclure@fs.fed.us

Project Objective: The objective of this project was to improve fish habitat conditions for an isolated population of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in the extreme headwaters of the South Fork Madison River. This project directly supports PM&E measure(s) FEIS Table 5-6 FERC Recommendation #99. Identify important riparian areas around Hebgen Reservoir and develop a plan to restore and protect these areas and 4.3.1 & 4.3.2 Fisheries TAC PM&E duties #7 evaluate the potential to enhance tributary spawning to increase to contribution of natural reproduction to the Madison River fishery.

Project Description: An old logging road had effectively captured 100 percent of the stream flow of a short section of the upper South Fork Madison River, thus drying up about 200 yards of original channel. During July of 2001 MCC and Forest Service crews constructed a vegetative revetment to divert stream flow back into the original stream channel and stabilized the outside meander bend. This action restored stream form and function, increase habitat availability, and reduced sediment delivery. Diverting stream flow back to the original channel also increased the amount of available habitat during low flow periods such as late summer and winter. The vegetative revetment was constructed of a soil encapsulated coir wrap with log and rock structural reinforcements. The revetments will be planted with willow and other native plant species in spring 2002 to insure long-term stability of the structure.

Partners: PPL Montana $3000 cash contribution, Montana Conservation Corps.$500 in-kind service and labor, Montana Fish Wildlife and Parks $1500 in-kind service, labor Gallatin National Forest $5000.

Monitoring: Stream channel and fish population response to flow diversion and stabilization will be evaluated after spring runoff in 2002. Photo points of diversion site have also been established.

Old roadbed before treatment.

Old roadbed after treatment.